Field Sampling Plan

(Appendix A to Remedial Design Work Plan)

Southeast Rockford Groundwater Site

Area 9/10

Rockford, Illinois

CERCLIS ID No. ILD9801000417

March 31, 2003

Prepared for:

HAMILTON SUNDSTRAND CORPORATION
4747 Harrison Avenue
Rockford, Illinois 61125

Submitted by:

SECOR International Incorporated
446 Eisenhower Lane North
Lombard, Illinois 60148

APPENDIX A
FIELD SAMPLING PLAN

Remedial Design
Area 9/10
Rockford, IL
SECOR Project No.: 13UN.02072.00
March 31, 2003

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SECTION 1.0

INTRODUCTION

This Field Sampling Plan (FSP) addresses the methodologies to be used for completion of the Pre-Design Investigation (PDI) field activities to support the various data collection activities to support the preparation of the final remedial design associated with the Area 9/10 portion of the Southeast Rockford Groundwater Contamination Superfund Site (SER site) located in the City of Rockford, Illinois (Figure 1). The term "Site" shall refer to Area 9/10 an industrial area in Rockford, Illinois, Winnebago County, Illinois, that is bounded by Eleventh Street on the east, Twenty-third Avenue on the north, Harrison Avenue on the south, and Sixth Street on the west. The Hamilton Sundstrand Corporation (HS) Plant #1 facility is located within Area 9/10 with an address of 2421 Eleventh Street. Figure 2 depicts the Site layout. The sample collection network design and rationale for the FSP was developed based on a review of previously implemented environmental assessments and investigations related to the Site. This FSP provides a description of the methods and techniques to be performed during the implementation of the investigation according to the RD Work Plan dated February 27, 2003 (Work Plan).

OBJECTIVES OF SAMPLING

The objective of this RD effort is to collect and evaluate additional site information to allow the preparation of a design package for the future performance of a Remedial Action (RA) to fulfill the goals the Record of Decision (ROD) established for Area 9/10. The ROD states that source materials (volatile organic compounds) exist within Area 9/10 that require remedial attention. These source materials are to be addressed through the application of two remedial technologies: 1) soil vapor extraction and 2) enhanced air-sparging. The goal of this RD effort is to prepare a remedial design package utilizing the selected remedial technologies. By setting forth the sampling rationale and methodology in the FSP, adherence to the plan should result in the collection of data that will be of sufficient quality for the intended purposes of the RD. The analytical methods chosen for the project are USEPA approved methods: 8260B

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FIGURE 1

Location Map

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FIGURE 2

Site Map

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for volatile organic compounds (VOCs), 8015B for diesel range organics (DRO), and 1311/6010B/7040A for Toxicity Characteristic Leaching Procedure (TCLP) metals.

INVESTIGATION SUMMARY

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This investigation for the RD has been designed to facilitate the collection of sufficient data to implement site remediation or construction of a remedy as defined in the Record of Decision (ROD). The PDI work elements have been developed to collect sufficient data to address the following considerations:

- Verify that the Remedial Action Objectives will be met, and that the remedy will achieve the specific remediation goals established for soils and groundwater.
- Determine background concentrations.
- Address ARAR compliance; primarily the requirement to establish an appropriate Groundwater Management Zone, and to ensure compliance with waste management rules and air pollution control regulations.

To obtain the necessary data to support these characterizations and evaluations the following activities will be performed:

Field Sampling Activities

The field sampling activities will predominantly consist of soil boring and monitoring well installation and the commensurate sample collection associated with these efforts. A series of soil borings will be advanced for the collection of samples to identify the presence of compounds of concern and to confirm geologic conditions within the area. About half of these soil borings will be completed as monitoring wells to allow for the gathering of information regarding the groundwater characteristics beneath the study area. In addition to the newly installed monitoring wells, several existing wells will be included in this sampling effort.

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Soil Borings

Thirty soil borings will be advanced during the PDI field activities. Fifteen of these borings will provide data concerning soil composition and source delineation only. The other 15 borings will also be used in conjunction with monitoring well installation.

Groundwater Monitoring Well Installation and Refurbishment

A total of 15 additional groundwater monitoring wells will be installed within Area 9/10 as part of the PDI field activities. There will be three groups of nested monitoring wells at Area 9/10. These well nests will be screened to monitor the unconsolidated aquifer groundwater at the water table, at an intermediate depth, and deep (maximum 130 to 150 feet below ground surface (bgs). The existing monitoring wells will be inspected to determine their integrity. Wells that are damaged will be refurbished, if possible, in order to serve as viable monitoring points. USEPA/IEPA monitoring wells that are damaged will be noted for replacement. If necessary, a new monitoring well may be installed near the damaged or abandoned well.

Figure 3 depicts the locations for the existing monitoring wells and the proposed monitoring wells. A description of the monitoring well installation is discussed later in this Section. The rationale for the monitoring well placement is described in Table 3.1.

Soil Sampling and Analysis

A total of 170 soil samples (not including quality assurance/quality control samples (QA/QC)) will be collected from the proposed 30 borings. All of the collected samples will be analyzed for VOCs and diesel-range organics (DROs for the evaluation of the jet fuel). In addition, select soil samples will be analyzed for RCRA TCLP metals in support of potential additional work activities (excavation of impacted soil within the former RCRA outside storage area (OSA)) that may considered or implemented by HS to meet other regulatory requirements. A description of the proposed soil sampling and analytical methods is provided further below.

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Figure 3

Sample Location Map

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Groundwater Sampling and Analysis

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A total of 23 groundwater samples (not including QA/QC samples) will be collected from proposed monitoring wells SMW-1 through SMW-15, existing recovery wells RW-1, RW-2, RW-3, and existing monitoring wells MW-3-FGA, MW-7-FGA, MW-201, MW-202, and MW-203. The collected samples will be analyzed for VOCs and DRO to evaluate the samples for the presence of chlorinated solvents and jet fuel.

Figure 3 depicts the proposed sampling locations associated with the further characterization of the Site.

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Pilot Study Sampling and Analysis

Additional intrusive and monitoring activities will be undertaken at the Site in conjunction with the Pilot Test at the OSA. Activities in association with the enhanced air-sparging (AS) System will consist of the installation of a sparge well and up to six monitoring points ranging from 15 to 20 feet from the sparge well. Activities associated with the soil vapor extraction (SVE) System will consist of the installation of an air extraction well and monitoring wells to assess the SVE performance. The ability for the AS/SVE to effectively treat impacted media will be monitored through sampling and analysis of select in-situ and AS/SVE system parameters. Planned parameters include:

- VOCs (groundwater and soil gas)
  - using SW-846 Method 8260B for groundwater
  - using SW-846 Method 0030/541A/8260B for soil gas
- Dissolved oxygen (groundwater)
- Redox potential (groundwater)
- PH (groundwater)
- Carbon Dioxide (groundwater)

The details regarding the construction and sampling in conjunction with the Pilot Test will be discussed in detail in the Pilot Test Work Plan. A map of the proposed Pilot Test layout is shown in Figure 4.

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Figure 4

Pilot Test System Layout

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Sample Location Map¶
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CONSTITUENTS OF CONCERN

Previous soil sampling at the Site had detected: methylene chloride (MCL) (possible laboratory artifact), 1,1,1-trichloroethane (TCA), trichloroethene (TCE), tetra-chloroethene (PCE), 1,1-dichloroethene (1,1-DCE) 1,2-dichloroethene (1,2-DCE), acetone, and toluene. The proposed soil samples will be analyzed for: VOCs, DRO for jet fuel, and RCRA metals using TCLP methodologies. Previous groundwater sampling had detected: 1,1-DCE, 1,1-dichloroethane (1,1-DCA), 1,2-DCE, TCA, PCE, toluene and xylene. The proposed groundwater samples will be analyzed for VOCs and DRO for jet fuel evaluation.

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PROJECT ORGANIZATION

The following provides the organizational structure and a description of the responsibilities of each entity identified.

Organizational Chart

This RD effort requires the combined efforts of HS and its contractor(s), the USEPA, and the IEPA. The organizational chart included as Figure 5 provides the outline of interactions and responsibilities of the various entities within the HS team and the USEPA and IEPA contacts.

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USEPA Remedial Project Manager

The USEPA Remedial Project Manager (RPM) is the primary point of contact for the USEPA. This individual has control over the administrative and technical aspects of the RD effort on behalf of the USEPA. The USEPA RPM will coordinate activities with the IEPA's Project Manager (PM) and HS/UTC. The USEPA designated RPM is as follows:

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Figure 5

Project Organizational Chart

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Mr. Russell Hart
United States Environmental Protection Agency, Region V
77 West Jackson Blvd.
Chicago, Illinois 60604-3590
T(312) 886-4844 F(312) 353-5541 or F(312) 886-4071
E-mail: hart.russell@epamail.epa.gov

Mr. Hart will be supported internally within the USEPA as necessary on legal issues by USEPA regional counsel. The USEPA regional counsel contact is as follows:

Mr. Thomas Turner
United States Environmental Protection Agency, Region V
77 West Jackson Blvd.
Chicago, Illinois 60604-3590
T(312) 886-6613 F(312) 886-0747
E-mail: turner.tom@epamail.epa.gov

State Regulatory Agencies

The IEPA will provide support to the USEPA and HS/UTC during the performance of this RD effort. The IEPA will work closely with the USEPA, the signatory authority on the AOC prescribing this RD effort. To this end, the IEPA will provide technical and administrative oversight of this RD on behalf of, and in conjunction with, the USEPA. The IEPA has identified its project manager to be as follows:

Mr. Thomas Williams
Illinois Environmental Protection Agency
12 Gunia Drive
PO Box 1515
LaSalle, Illinois 61301-3515
T(815) 223-1714 F(815) 223-1344
E-mail: epa4414@epa.state.il.us

Mr. Williams will be supported by other IEPA personnel as necessary. Additional RD support will be provided by the following IEPA senior personnel:

Mr. Terry Ayers
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, Illinois 62702
T(217) 782-9875 F(217) 557-1165
E-mail: epa4126@epa.state.il.us

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The USEPA Remedial Project Manager (RPM) is the primary point of contact for the USEPA. This individual has control over the administrative and technical aspects of the RD effort on behalf of the USEPA. The USEPA RPM will coordinate activities with the IEPA's Project Manager (PM) and HS/UTC. The USEPA designated RPM is as follows:

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Oversight Contractors

At this time, the USEPA has not designated an oversight contractor for this effort. The IEPA has indicated that Camp, Dresser, & McKee, Inc. (CDM) will provide oversight on behalf of the IEPA. The primary contact for CDM for the oversight effort is as follows:

Kent Whiting
Camp, Dresser, & McKee, Inc.
125 South Wacker Drive
Suite 600
Chicago, Illinois 60606
T(312) 396-5000 F(312) 346-5228

Project Coordinator

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The Project Coordinator (PC) is HS's designated individual to interact with the USEPA and the IEPA with regard to this RD effort. The PC will be supported by additional HS and UTC personnel as well as primary and secondary subcontracted entities. The combination of these entities under the direction of the PC will be responsible for the implementation of the activities identified in this RD Work Plan. The PC for the RD effort on behalf of HS is as follows:

Mr. Scott Moyer
United Technologies Corporation
Mail code M/S 296-6
4747 Harrison Street
Rockford, Illinois 61108
T(815) 226-6232 F(815) 226-2699
scott.moyer@hs.utc.com

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Mr. Moyer will be supported internally as necessary on legal issues by UTC corporate counsel. The UTC corporate counsel contact is as follows:

Mr. Eric Alletzhauser
United Technologies Corporation
One Financial Plaza
Hartford, Connecticut 06010
T(860) 728-7895 F(860) 728-6227
alletzew@corphq.utc.com

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The PC will be supported by personnel from SECOR, HS/UTC's primary contractor, for the implementation of this RD Work Plan. As indicated in the organizational chart previously presented in this section, SECOR has designated the following individual as the Project Manager (PM) responsible for this RD effort.

Mr. David Curnock
SECOR International Incorporated
446 Eisenhower Lane North
Lombard, Illinois 60148
T (630) 792-1680 F(630) 792-1691
E-mail: dcurnock@secor.com

Mr. Curnock will be supported by other SECOR technical, administrative, quality, and health and safety staff. In addition to SECOR personnel, various subcontractors and suppliers will be utilized in the performance of the RD effort. The two significant subcontractors will be Severn Trent Laboratories (STL) for analytical laboratory services and Mid America Drilling for soil boring and monitoring well installation services.

Field Site Manager

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The Field Site Manager (FSM) will be responsible for the safe and proper performance of the field activities to be undertaken as part of the RD process. These activities will include site reconnaissance, mobilization, sampling, pilot testing, and demobilization. The FSM will coordinate field efforts with subcontractors, facility personnel, SECOR staff, and agency personnel during the performance of the on site activities. The FSM will provide the direct communication link from the field site to the PM. As indicated in the organizational chart, SECOR has designated the following individual as the FSM for this effort.

Mr. Mark Densmore
SECOR International Incorporated
400 Bruns Lane
Springfield, Illinois 62702
T (217) 698-7247 F(217) 698-8538
E-mail: mdensmore@secor.com

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SECTION 2.0
SITE RECONNAISSANCE AND MOBILIZATION

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In support of RD activities, HS intends to conduct supplemental surveys at Area 9/10. The surveys will include property boundaries, utility rights-of-way, historical, and topographic information that could affect the selection of locations for intrusive data collection activities (i.e. borings), location and performance of Pilot Study activities, and the ability to complete the design of the selected remedial alternative.

To perform some of the PDI activities, it will be necessary to secure access to properties beyond the direct control of HS. At this time, some of the properties identified consist of the City rights-of-way, Rockford Products parking lot (vicinity of MW201, south of HS facility), and the former Nylint Corporation property. Attempts to gain access will be made via direct discussion and written documentation. Should HS not obtain access after several attempts within a reasonable time frame, the USEPA and IEPA will be asked to assist in obtaining access.

Much of the information to be compiled as part of the reconnaissance effort will be obtained through existing available sources such as the City of Rockford Department of Public Works for underground water and sewer lines. Other utility information will be derived from facility sources, other utility providers, and by direct locating/identification techniques.

In support of the underground utility/structure identification activities, an electromagnetic (EM) survey or ground penetrating radar (GPR) survey may be performed in certain areas. Such surveys would be conducted to verify or determine the presence of subgrade structures or conditions for the purposes of soil boring/monitoring well location and future design criteria development, such as the vicinity of MW-201 located in the Rockford Products parking area.

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As part of the readiness preparation (mobilization) for the field sampling activities, logistic support items such as work areas, mobile office space, sanitary facilities, and communications will be emplaced.

The EM and/or GPR survey efforts will be subject to information developed as part of the Site Reconnaissance activities. Based on the general soil conditions known to be present (predominantly sands), both EM and GPR technology applications are appropriate and may be used in combination. Instrumentation and operation will be provided by subcontracted services proficient and experienced in such surveys. At this time the area of greatest concern for the employment of the survey is the vicinity of MW201. The general procedure for the performance of this survey will begin by positioning a grid covering approximately 22,500 square feet (150 feet x 150 feet) over the area surrounding MW-201. A grid interval of ten feet will be used resulting in approximately 15 transects with 225 grid nodes. Measurements will be recorded for each grid node. Readings will be presented in table and figure form for evaluation. The evaluation process will include the identification, if any, of anomalous conditions or disturbances which may represent historical filling or subsurface structures such as pipelines, tanks, drums, etc.

As part of the readiness preparation (mobilization) for the field sampling activities, logistic support items such as work areas, mobile office space, sanitary facilities, and communications will be emplaced. These work areas will consist of office, storage and staging areas for equipment and supplies located within the confines of the HS facility property. Sampling supplies and equipment, decontamination supplies and equipment, along with investigation derived waste handling and storage equipment will be located in these work areas. At this time, storage and staging activities will be focused on a portion of the HS facility parking area near the former RCRA OSA near Ninth Street, north of the facility building.

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SECTION 3.0
SAMPLING METHODS AND PROCEDURES

The following section is broken down into the major components of the PDI consisting of the advancement of soil borings, the completion of monitoring wells, and the sampling of monitoring wells. Specific methodologies used in the completion of these tasks are described in detail in the Standard Operating Procedures (SOPs) contained in Appendix A. Examples of blank forms to be used while completing field activities are included in Appendix B.

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SOIL BORINGS

Prior to drilling activities all locations will be checked for the presence of subsurface and overhead utilities. Methods of subsurface utility clearance will include: JULIE, consultation with facility representatives, pre-probing the upper 5 feet of soil, and in select locations vacuum excavation might be used (see SOP A-1). Soil sampling will be performed in association with the soil borings. Some of the borings will be advanced to accommodate monitoring well installations. A total of 30 soil borings will be advanced, 15 of which will be converted into monitoring wells. Figure 3 depicts the soil boring locations and Table 3.1 describes the rational for the soil boring locations. Procedures for the advancement of soil borings are included in SOP A-2, entitled "SOP for soil boring completion" presented in Appendix A. Soil borings not completed as monitoring wells will be abandoned in accordance with SOP A-7 entitled "SOP for boring/well abandonment" presented in Appendix A.

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Soil samples associated with the soil borings will be retrieved continuously using a hollow stem auger drill rig. The retrieved undisturbed samples will be field screened for VOCs using a Photoionization Detector (PID) calibrated to an isobutylene standard. Portions of each core exhibiting the highest PID reading will be segregated from the soil core and placed in a plastic bag. The sample placed in the plastic bag will be allowed to equilibrate at ambient temperatures for 10 minutes and then be measured for

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headspace. A sample from each segregated sample will also be placed in a cooler. Procedures for field screening using a PID are included in SOP A-14, entitled "SOP for field screening using a photo-ionization detector" presented in Appendix A.

The soil samples for laboratory analysis from the eight borings at the OSA (S-1 through S-8) will be collected in two-foot intervals. A single sample each two foot interval with the highest PID headspace above background will be submitted to the laboratory for analysis. If an interval does not have soil containing elevated PID readings, but exhibits staining, then the stained portion will be submitted for laboratory analysis. In the absence of elevated PID readings or staining, the sample to be submitted for laboratory analysis will be collected from the interval at the discretion of the field personnel.

The soil samples from the remaining twenty-two borings will be collected on a continuous basis. Up to two samples for laboratory analysis will be collected from each boring. A sample will be collected from the interval in the boring exhibiting the highest PID headspace. If a boring does not exhibit elevated PID readings but does exhibit staining, then a sample will be collected from the stained interval. In the absence of elevated PID readings or staining, one sample will be collected from an interval just above the water table interface. Procedures determining the sample intervals in soil borings are included in SOP A-9, entitled "SOP for soil sample target zone and sample selection" presented in Appendix A.

Subsurface material will be visually and manually classified by the field geologist under the supervision of a geologist certified in the state of Illinois. Logs of the borings indicating the depth and identification of various strata, rate of advancement, water elevation information, and pertinent information regarding the method of maintaining and advancing the drill hole will be made. Procedures for the completion of field logs for borings are included in SOP A-4, entitled "SOP for the completion of field logs of borings" presented in Appendix A. Procedures for describing soils are included in SOP A-5, entitled "SOP for soil boring completion" presented in Appendix A. Procedures for describing rocks are included in SOP A-6, entitled "SOP for rock descriptions"

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presented in Appendix A. Charts illustrating the soil classification procedure, the descriptive terminology and symbols used on the boring logs will be available for review and included in the Data Evaluation Summary Report.

The extent and distribution of soil contamination will be characterized through the analyses of VOCs, DRO for jet fuel identification, and RCRA metals by TCLP. Samples for VOC analysis will be collected in accordance with Method 5035 with a syringe sampler, and extruded into 40-ml glass vials preserved with methanol and sodium bisulfate provided by the laboratory conducting the analyses. Each VOC soil sample will require 5 gram samples extruded into two sodium bisulfate pre-weighed vials for low level analysis, a 5 gram sample extruded into one methanol preserved pre-weighed vial for medium level analysis, and one non-preserved 4-ounce glass container filled with soil for percent total solids determination. Procedures for collecting samples in accordance with method 5035 are included in SOP A-15, entitled "SOP for Method 5035: field preservation, collection, and handling instructions for vials" presented in Appendix A. Samples for DRO analysis and TCLP metals will each be collected in 4-ounce glass containers provided by the laboratory conducting the analyses. Disposable nitrile gloves will be worn during the sampling event. Soil samples will be collected based on the screening methods previously mentioned and in accordance with the FSP. Duplicate and field blank samples will also be collected in accordance with the QAPP.

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Soil samples will be placed on ice in a cooler in the field following collection. Upon collection of the sample, a description of the sample will be recorded in the project field book along with the sample collection time and the sample identification number. The sample number, interval, and time will also be annotated on the field boring log.

Decontamination

All down-hole drilling equipment will be steam-cleaned prior to initiation of any drilling activities and between each boring. All decontamination wastes will be containerized and retained at a secure location on-site pending results of characterization analyses

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(VOCs by USEPA Method 8260B). Procedures for decontamination are included in SOP A-23, entitled "SOP for decontamination procedures" presented in Appendix A Once characterized, appropriate disposal of this material can be initiated.

MONITORING WELLS

Prior to drilling activities all locations will be checked for the presence of subsurface and overhead utilities. Methods of subsurface utility clearance will include: JULIE, consultation with facility representatives, pre-probing the upper 5 feet of soil, and in select locations vacuum excavation might be used (see SOP A-1). All monitoring well installations will be performed by a contractor using a hollow stem auger with a continuous sampler. The procedures for the installation of these wells are presented in the following sections. Figure 3 depicts the locations of the existing and proposed monitoring wells. Table 3.1 describes the rational for the monitoring well locations

Monitoring Well Installation

All monitoring wells will be constructed and installed in accordance with current USEPA and IEPA standards relating to the installation of monitoring wells in aquifers. The groundwater monitoring wells will be constructed of two-inch inside diameter (I.D.), 15-foot long #20 slot, stainless steel well screens connected to the ground surface by two-inch I.D., schedule-40 PVC well casing and/or two-inch stainless steel riser. The water table at the site is approximately 30-35 feet below ground surface (bgs). The average monitoring well screen for the wells intended to monitor the upper portion of the saturated zone will be placed in a manner as to bisect the water table at a ratio of 5 feet above the water table and 10 feet below the water table. Procedures for the installation of monitoring wells are included in SOP A-3, entitled "SOP for the completion of groundwater monitoring well boreholes" presented in Appendix A. Three nested groups of wells are proposed which will each contain a well which in addition the well screened across the water table will also have a well screened at an intermediate depth (approximately 80–100 feet bgs) and one screened at a deeper depth (approximately

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120-150 feet bgs or less). All wells will be advanced in the unconsolidated aquifer, which is believed to be predominately composed of sand. The deep wells will be drilled until a clay aquitard is encountered or to a maximum depth of 150 feet bgs. No borings are planned to be completed to depths greater than 150 feet bgs.

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The borehole annulus, from the bottom of the boring to a point approximately 2 feet above the top of the screen, will be backfilled with clean, medium-grained washed sand, or an appropriate alternative. The remaining borehole annulus will be backfilled with cement/bentonite grout to land surface. The monitoring wells will be completed at the surface as flush mounted vaults. At the nested well locations, the deep well will be installed first to help corroborate the appropriate well screen elevations for the subsequent well installations.

Each well will be developed by either pumping or bailing following its installation. Procedures for developing wells are included in SOP A-17, entitled "SOP for well development" presented in Appendix A. Development will continue (within reason) until water from the well is free of suspended sediments.

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All down-hole drilling equipment will be steam-cleaned prior to initiation of any drilling activities and between each boring. Continuous samples will be screened with a PID for the presence of volatile constituents. All soil cuttings and decontamination fluids will be containerized and retained in a secure location on-site pending the results of characterization analyses. Once characterized, appropriate disposal of this investigation derived waste (IDW) will be initiated

Monitoring Well Refurbishment

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The existing monitoring wells will be inspected to determine their integrity. Wells that are damaged will be refurbished, if possible, in order to act as viable monitoring points. USEPA/IEPA wells that are damaged will be noted for replacement. These repairs will most likely be in the form of surficial repairs such as repairing surface grout, casing guards, and well covers. Monitoring wells that are damaged beyond repair will be

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brought to the attention of the USEPA/IEPA. If necessary, a new monitoring well will be installed near the damaged or abandoned well. Procedures for abandoning a monitoring well are included in SOP A-7, entitled "SOP for boring/well abandonment" presented in Appendix A.

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Survey of Monitoring Wells

All monitoring well locations will be surveyed with respect to a known United States Geological Survey datum point (providing easting and northing) by a land surveyor licensed in Illinois. In addition, the surface elevations of each soil boring and the measuring point elevations of each monitoring well will be surveyed.

GROUNDWATER SAMPLING

Fluid Level Measurements

Prior to sampling the monitoring wells, fluid level measurements will be taken at each individual well. Measurements will be taken with a water level meter capable of measuring to the nearest 0.01 feet. Total depth of the well and depth to water will be recorded for each well. Between wells, the water level indicator cable or tape will be decontaminated using an alconox and water spray followed by a distilled water rinse. These data will be noted in the project field book and water elevation data sheets. The data will be presented in the Data Evaluation Summary Report.

Monitoring Well Purging

Monitoring wells will be purged prior to sampling. At least three well volumes will be removed during the purging process, unless the well purges dry, at which point the well will be allowed to recharge a sufficient amount to collect the required samples. The

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amount of water to be purged per well volume will be calculated according to the following formula:

$(3.1416 \times (r/12)^2) \times (TD-DTW) \times 7.481 = 1$ well volume (gallons)

Where,

r = well radius (inches)

TD = total well depth (feet)

DTW = depth to water (feet)

3.1416 = π

7.481 = constant (gallons per cubic foot)

Field readings of pH, temperature, and conductivity will be performed on samples collected from each purge volume, and noted in the field notebook. Procedures for using and calibrating the pH/temperature/conductivity meter in are included in SOPs A-10, A-11, A-12, and A-13 entitled "SOP for HYDAC™" presented in Appendix A. A well will be considered adequately purged for sampling when the readings have stabilized ± 10 percent over consecutive readings. If during the purging process the well purges dry, the well will be allowed to recharge a sufficient amount to collect the required samples, the well will be considered adequately purged and the samples will be collected.

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The pH/temperature/conductivity meter will be calibrated at the beginning of each day, and again during the midpoint of each day's sampling event. Purge water collected during the sampling event will be containerized and retained at a secure location on-site pending results of characterization analyses (VOCs by USEPA Method 8260B). Once characterized, appropriate disposal of this material will be initiated.

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Groundwater Sample Collection

The extent and distribution of groundwater contamination will be characterized through the analyses of VOCs and jet fuel (DRO analysis). Samples for VOC analysis will be collected in 40-ml glass vials provided by the laboratory conducting the analysis. Samples for DRO analysis will be collected in two 1-liter glass containers provided by the laboratory conducting the analysis. Disposable nitrile gloves will be worn during the sampling event. Monitoring wells will be sampled from the anticipated cleanest to the most impacted. During sampling, the bailer will be slowly lowered into the well water. VOC samples will be collected by slowly decanting the water in the 40-ml glass vials (Table 3-2). Vials will be filled until a convex meniscus is present, and then capped. The cap will then be secured and checked for trapped air. Any samples with entrained air will be discarded, and new samples collected. The DRO samples will be collected by bailer and decanted into the provided containers. Duplicate and field blank samples will also be collected in accordance with the Quality Assurance Project Plan. Procedures for collecting groundwater samples in are included in SOP A-18, entitled "SOP for groundwater sampling from observation/monitoring wells " presented in Appendix A. Procedures for collecting groundwater samples are included in SOP A-19, entitled "SOP for groundwater sampling from recovery wells " presented in Appendix A. Light non-aquious phase liquids (LNAPL) may be encountered during ground water sampling. If a decision is made to sample the LNAPL, then the procedures are discussed in SOP A-21, entitled "SOP for collecting LNAPL samples" presented in Appendix A. Procedures for handling and transport of LNAPL are included in SOP-24 entitled "SOP for LNAPL sample handling and transport" presented in Appendix A.

Groundwater samples will be placed on ice in a cooler in the field following collection. Field checklists will be used to verify the proper execution of the sampling tasks. These forms will be completed as part of the field notebook documentation, and submitted with the report. An example of the field sampling forms is provided in Appendix B.

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Table 3.1 Rationale for Soil Boring/Monitoring Well Placements			
Soil Boring/ Monitoring Well Number	**Boring depth/ Screen Interval Below Ground Surface**	**Location**	**Purpose**
S-1 through S-8	TD approximately 30 feet	OSA	To collect soil and analytical information to aid in the design of the RD Pilot Test.
S-9 through S-12	TD approximately 30 feet	Loading Dock Area near the North Alley	To collect soil and analytical information to aid in the RD.
S-13 through S-14	TD approximately 30 feet	Former Container Storage Area Plant #1	To collect soil and analytical information to aid in the design of the RD.
S-15	TD approximately 30 feet	Near the southwest HS property boundary	To collect soil and analytical information to aid in the design of the RD.
SMW-1	Screen interval approximately 25-40 feet	Northwest from the HS property, along south side of 23rd Avenue	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-2	Screen interval approximately 25-40 feet	North from the HS property, along the south side of 23rd Avenue	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-3	Screen interval approximately 25-40 feet	Northeast from the HS property, along south side of 23rd Avenue	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-4	Screen interval approximately 25-40 feet	Along the west side of HS property boundary, east of 9th Street	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-5	Screen interval approximately 25-40 feet	Near the southwest corner of the HS property boundary	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-6	Screen interval approximately 25-40 feet	Near the southwest portion of the property, south of the South Alley	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-7	Screen interval approximately 25-40 feet	Near the south-central portion of the property, south of the South Alley	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-8	Screen interval approximately 25-40 feet	Along the west side of the HS property, south of the North Alley	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.
SMW-9	Screen interval approximately 80-100 feet	Near the southwest portion of the HS property, south of the South Alley near MW-201	To collect groundwater monitoring data from a intermediate interval of the saturated zone in that area of the site.
SMW-10	Screen interval approximately 120-150 feet	Near the southwest portion of the HS property, south of the South Alley near MW-201	To collect groundwater monitoring data from the deeper interval of the saturated zone in that area of the site.
SMW-11	Screen interval approximately 80-100 feet	Near the southeast portion of the HS property, south of the South Alley near MW-7-FGA	To collect groundwater monitoring data from a intermediate interval of the saturated zone in that area of the site.
SMW-12	Screen interval approximately 120-150 feet	Near the southeast portion of the HS property, south of the South Alley near MW-7-FGA	To collect groundwater monitoring data from the deeper interval of the saturated zone in that area of the site.
SMW-13	Screen interval approximately 80-100 feet	Near the southwest portion of the Former Mid-States Industrial property, north of the North Alley near MW-3-FGA	To collect groundwater monitoring data from a intermediate interval of the saturated zone in that area of the site.
SMW-14	Screen interval approximately 120-150 feet	Near the southwest portion of the Former Mid-States Industrial property, north of the North Alley near MW-3-FGA	To collect groundwater monitoring data from the deeper interval of the saturated zone in that area of the site.
SMW-15	Screen interval approximately 25-40 feet	North of the Loading Dock area and south of the North Alley.	To collect groundwater monitoring data from the upper interval of the saturated zone in that area of the site.

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SECTION 4.0
SAMPLE METHODOLOGIES AND NUMBER OF SAMPLES

This section presents a description of the laboratory analytical methods and required sample containers to be used for the collection and analysis of soil and groundwater samples.

ANALYTICAL PARAMETERS

Soil investigation derived waste (IDW) samples associated with the monitoring well installation will be analyzed for VOCs using USEPA SW-846 Method 8260B, and RCRA metals using USEPA SW-846 Method 1311/6010B/7040A. A summary of the sample numbers, matrices, and methodology is presented on Table 4.1. Sample containers, necessary preservation(s), and holding times for the analytical Methods are listed on Table 4.2.

TABLE 4.1
Samples Collected by Matrix for Potential Residual Soil and Groundwater Contamination Occurrence and Distribution Assessments

	Soil			Groundwater [1]			IDW [2]
Parameters	Field	QC		Field	QC		Soil/Water
SW846 Method 8260B (VOCs)	170	9		23	3		2
SW846 Method 8015B (DRO as Jet Fuel)	170	9		23	3		--
SW846 Method 1310/6010B/7470A TCLP metals	120	3		--	--		2

Foot Note:

[1] 40 ml VOA vials will be laboratory preserved with HCl acid.

[2] IDW samples will be collected at a minimum of one sample per roll off for soil or tote tank for water

[3] QC samples include one rinse blank, one duplicate, one MS/MSD, and one trip blank.

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TABLE 4.2
Sample Containers, Preservatives, & Holding Times

Matrix	Parameter/ Analytical Method	Sample Container	Preservative	Holding Time To Extraction
Soil	VOCs (5035/8260B) *	6-40ml glass vials** 4 oz.	2- Sodium Bisulfate 2 - Methanol 2– Water*	14 Days
	JP-4 (3541/8015B)	4 oz.	Cool, 4 +/- 2°C	14 Days to Extract 40 days to Analyze
	TCLP Metals Mercury (1311/6010B/7470A)	8 oz. glass jar	Cool, 4 +/- 2°C	To TCLP: 180 days (excp. Hg) 28 Days (Hg) To Analyze: 180 days (excp. Hg) 28 days (Hg)
Groundwater	VOCs (5030B/8260B)	3-40 ml glass vials	HCl; pH <2 Cool, 4 +/- 2°C	14 Days
	Jet fuel DRO (3520C/8015B)	2 -amber glass 1 liter bottles	Cool, 4 +/- 2°C	7 Days to Extract 40 days to Analyze

* If samples show evidence of effervescence (i.e., bulging septa, fizzing, hissing when auto-sampler punctures septa, etc..) upon sample receipt, the laboratory will notify SECOR. Additionally, the analyst needs to proceed with the analysis using Method 5030B purge & trap using an appropriate aliquot from the VOA jar or solids jar if available. In addition, samples that react with sodium bisulfate may be collected and placed in vials containing water without the preservative. The vials are kept < –12°C until analysis. Such samples must be thawed prior to analysis. The maximum holding time for this type of collection and preservation is 7-days from the collection date.

** Additional 2 vials required for the MS/MSD sampling point.

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SECTION 5.0
PROJECT DOCUMENTATION

FIELD DOCUMENTATION

Field logbooks will provide the means of recording data collection activities performed. Field logbooks will be bound, field survey books or notebooks. Logbooks will be assigned to field personnel, and will be the responsibility of the individual person until field activities are concluded; at which time the field notebook will be returned to the project file. Each logbook will be identified by the project-specific document number. The title page of each logbook will contain the following:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Project end date

Entries into the logbook will contain a variety of information. At the beginning of each day's activities, the date, start time, weather, names of personnel on-site, level of personal protection being used, and equipment and/or subcontractors on-site will be noted. Each page of the field notebook will be initialed and dated by the author. The names of visitors to the Facility, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field notebook.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected, or a measurement made, a detailed description of the location, which includes direction and distance measurements, shall be recorded. The number of photographs taken of the

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location, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

The equipment used to collect samples will be noted, along with the time of sampling, sample description, and depth at which the sample was collected. Sample identification numbers will be noted for both field and QC samples.

SAMPLE DESIGNATION

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Samples will be collected according to the following the sampling procedures. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. Sample site-specific identification number will be assigned prior to sample collection. The site-specific sample number should consist of the following:

- Project Identification Code: A designation will be used to identify the site where the sample was collected. The project identification code for long term groundwater monitoring, perimeter groundwater containment system monitoring, and natural attenuation study activities is PDI.

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- Sample Matrix and Location Code: Each sample should be identified in the field notebook by an alpha-numeric code corresponding to the sample matrix/type, followed by a three-digit sample location number. The alpha-numeric codes which will be used for the PDI are:

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  - FB - Field blank
  - GW - Groundwater samples
  - SB - Soil boring samples
  - TB - Trip blank
  - FD - Field duplicate

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The location code will follow the sample type code. The location code consists of a two- to five-digit numeric or alpha-numeric code that indicates the sample location. Location codes lower than 10 will be preceded by '0', e.g. '01'; '02'; etc. Private well samples location codes will be letters. Soil, field duplicate, trip blank, and field duplicate samples will use a consecutive numbering system starting at 01.

The Round Code will follow the location code. The round numbers for all samples will be a two-digit number preceded by a hyphen, beginning with 01. Round 01 represents samples collected during the PDI.

- Examples of Sample numbers:

  - RD-GWMW22-01 = PDI, groundwater sample from well MW22
  - RD-GWFD01-01 = PDI, duplicate groundwater sample number 01
  - RD-GWFB01-01 = PDI, field blank 1, round 1
  - RD-SB01(7-8)-01 = PDI, soil sample from boring SB01, collected from a depth of 7 to 8 feet, round 1

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The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. Examples of field custody documents are found in Appendix B.

SAMPLE LABELING

Samples will be labeled using laboratory supplied sample labels. Labels will be covered with transparent tape after marking, and will include the following information:

- Sample identification number (specific for each project task);
- Project number;

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- Date and time of collection;
- Sample matrix (soil or water);
- Analysis requested;
- Name of sampler(s); and
- Type of preservative (if applicable).

SAMPLE CUSTODY, STORAGE, AND SHIPPING

All samples will be accompanied by a properly completed Chain of Custody form. The sample numbers and locations will be listed on the Chain of Custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to an on-site laboratory, to an off-site laboratory, or to/from a secure storage area.

Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed Chain of Custody record enclosed in each sample box or cooler. Shipping containers will be locked and secured with strapping tape in at least two locations for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler.

All shipments will be accompanied by the Chain of Custody Record identifying the contents. The original record will accompany the shipment, and remaining copies will be retained by the sampler and returned to the Project Manager or project file. If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading must be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

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SECTION 6.0
SAMPLING EQUIPMENT DECONTAMINATION AND WASTE DISPOSAL

Equipment for the groundwater sampling will consist of a pH/conductivity/ temperature meter, disposable polyethylene tubing (or equivalent) and a submersible sampling pump, new polyethylene disposable bailer and dedicated nylon rope. In addition, a water level indicator meter will be used to measure the total depth of the monitoring well and the depth to groundwater. The following outlines methods and procedures for decontamination of the described equipment and instruments.

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EQUIPMENT DECONTAMINATION

The drilling equipment used to advance the borehole will be decontaminated between each boring location by steam cleaning the down-hole equipment. Sampling tools, spatulas, soil knives, etc. will be washed with a non-phosphate detergent and rinsed with distilled water prior to and between uses (see SOP A-23). Water generated as part of the equipment decontamination process will be collected and containerized at a secure location pending characterization and appropriate disposal.

Decontamination water and purge water collected during the groundwater sampling activities will be containerized at a secure location pending characterization for appropriate disposal.

SAMPLING EQUIPMENT CALIBRATION

A pH/conductivity/temperature meter will be used during the groundwater sampling activities to measure stabilization of the specific groundwater parameters to ensure collection of representative groundwater samples (see SOPs A-10, A-11, A-12, and A-13). A PID will be used for the screening of soil samples collected during the field

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investigation. Field monitoring equipment will be calibrated and operated according to the manufacturer's specifications (see SOP A-14). Field calibration procedures, at a minimum, will include the following:

- Documentation of the calibration in a dedicated log book for the instrument or in the daily log book of the person conducting the calibration.

- Daily log book entries when the instrument is in use. Entries will also be made in an air monitoring sheet. An example of a bland air monitoring log is presented in Appendix B.

- A record of calibration in the log book that will include the calibrator's name, the standards used, the date/time of calibration, and corrective action taken, if necessary. A blank air monitoring equipment calibration/check log is presented in Appendix B.

DISPOSAL OF INVESTIGATIVE DERIVED WASTE

IDW anticipated to be generated during this field effort will consist of soil cuttings associated with the soil investigation, soil cuttings associated with the installation of the monitoring wells, groundwater generated as part of the monitoring well installation, development and sampling processes, and fluids generated during decontamination activities. Soil cuttings generated during the soil and monitoring well installation activities will be evaluated during generation with a PID and visually. Soil cuttings that exhibit signs of impacts (elevated PID readings, visual staining) will be stored separately from the remaining soils. Segregated soils (those that exhibit elevated PID readings, odors, staining), will be sampled for disposal analysis after completion of the soil boring/monitoring well installation processes. Soils will be placed in a lined roll-off box and covered. Soil samples will be collected from each roll off box. Samples will be submitted to the laboratory for VOCs analyses by

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USEPA Method 8260B, and TCLP metals analysis by USEPA methods 1311/6010B/7040A and any other disposal facility prescribed parameters.

Water and decontamination fluids will be containerized in 55-gallon drums or bulked into a polyethylene tote tank for storage prior to disposal/treatment. Representative samples will be collected from the drums and or tote tank(s) and analyzed for VOC and metal content along with any other disposal facility required parameters.

At this time, it is anticipated that the IDW materials will be managed as non-hazardous wastes (by characteristic evaluation).

PERSONAL PROTECTIVE EQUIPMENT

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Personal protective equipment (PPE) used by personnel at the Site will be visually inspected for contamination during removal. If no evidence of contaminant staining is visible then the PPE will be double bagged (trash bags) and disposed of in an on-site dumpster specified for this purpose for ultimate disposal at a sanitary landfill. If contamination is present on the PPE, the PPE will be containerized in an on-site 55-gallon drum designated for this purpose and disposed of as IDW.

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APPENDIX A TO FIELD SAMPLING PLAN
STANDARD OPERATING PROCEDURES

SECOR Project NO.: 13UN.02072.00.0001

March 31, 2003

APPENDIX B TO FIELD SAMPLING PLAN
BLANK FIELD FORMS

SECOR Project NO.: 13UN.02072.00.0001

March 31, 2003

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GROUNDWATER SAMPLING FIELD DATA SHEET¶
SECOR Project NO.: 13UN.02072.00.0001¶
January 29, 2003¶

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APPENDIX A

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A-1

SOP FOR PRE-FIELD DRILLING ACTIVITIES

The following procedures are to be followed prior to the commencement of drilling activities at the Site:

1. Notify the appropriate state agency of intention to drill/install wells. This will often be the State Engineer's Office, but may vary by state.

    1.1 Include the following information in the Notice of Intent:
        1. Site Address/Location
        2. Site Cadastral Coordinates - Township, Range, Section
        3. Number and Type of Wells to be Drilled (i.e. 2" Groundwater Monitoring Well)
        4. Proposed Depth
        5. Land Owner
        6. Party Responsible for Wells (usually the client)
        7. Reason for Installing the Wells
        8. Proposed Drilling Date

2. Obtain local agency drilling permit(s), as necessary.

3. Obtain State Department of Transportation (or Municipality) Permits if well will be in a public right-of-way or private property access agreements if well will be on adjacent property.

4. In support of the underground utility/structure identification activities, an electromagnetic (EM) survey and/or ground penetrating radar (GPR) survey may be performed in select areas as outlined in Section 2.0.

5. Establish a mobile office space, sanitary facilities and communication system at the site for SECOR and USEPA.

6. The drilling contractor will arrange for utility locates. Appropriate employees from the drilling contractor and SECOR will attend locates personally. Also present at the utility locates on facility property will be a facility representative. Note overhead utilities. **Complete a signed Utilities and Structures Checklist (Attached Form) for each hole prior to drilling.**

7. Call and schedule drilling company.

    7.1 Specify well type, construction, depths, and completion details.

    7.2 Specify soil/rock sampling requirements.

8. Submit laboratory work/bottle order.

9. Review the current Health and Safety Plan (HASP) for the Site.

   9.1 Provide copy of the HASP to the drilling company in advance.
   9.2 Request proof of drilling company's OSHA safety training and medical surveillance in advance

10. Schedule required equipment and obtain needed supplies. A typical list includes:
    - Hand Auger and shovel
    - Ziplock® or equivalent sealable plastic bags
    - Paper Towels
    - Field Notebook
    - Permanent Markers/Pens
    - Water Level Indicator or Interface Probe
    - Tile probe
    - Photo-ionization Detector (PID) & Calibration Gas
    - Alconox® or similar low-phosphate cleaning agent
    - De-ionized Water
    - Nitrile Gloves
    - Disposable Bailers
    - Nylon Rope or Twine for Bailers
    - Sample containers and cooler
    - Level D Safety Equipment (Hard Hat, Boots & Safety Glasses)

**** If possible, borehole locations will be hand augured or tile probed to a depth of five feet before drilling.** (Except in areas where underground structure removal has occurred.)**

Note: In cases where hand auguring is necessary, continuous split spoon samples will also be collected to a depth of five feet within approximately 1 foot of the hand-augured hole for the purposes of sample collection. In select locations, vacuum excavation might be used.

A-2

SOP FOR SOIL BORING COMPLETION

Prior to the drilling of soil borings, scheduled drilling sites will be cleared for utilities and structures by the environmental contractor or their subcontractors. A Utilities and Structures Checklist will also be filled out and signed prior to drilling and excavation activities. A copy of this form is included in Appendix B.

Drilling will be accomplished using either a direct-push rig (Geo-Probe® type), or hollow-stem auger or air rotary or percussion drilling equipment or other applicable drilling rig capable of collecting continuous samples (split-spoon and/or dry core barrel) from the surface to the base of each hole. During drilling of soil borings, a continuous, descriptive, lithologic log will be prepared by a qualified geologist or geotechnical individual based on an examination of the split-spoon samples and soil cuttings. A copy of a blank boring log form is included in Appendix B. In the event that the soil boring can not be completed to a satisfactory depth, an alternative site may be chosen.

Continuous split-spoon samples will be obtained at each soil boring. The soil cores recovered in each split-spoon will be screened in the field for the presence of hydrocarbon constituents through visual examination and using a Photo-ionization Detector (PID). Soil samples will be selected based on staining, odor and elevated PID values and submitted to the laboratory for chemical analysis, according to the SOP entitled “SOP for Sample Target Zone and Sample Selection”. These samples will be collected to assist in the identification and quantification of the vertical distribution of selected constituents that may be present in soils.

Borehole cuttings will be both continuously screened for volatile organic compounds (VOCs) and visually examined for signs of staining; those cuttings with either VOCs detected or heavy staining will be stockpiled separately from those soils that are VOC free.

If unsaturated conditions are unexpectedly encountered in boreholes intended for monitoring well completion, the borehole will be left open for 24 hours to determine whether low permeability conditions are retarding groundwater movement. If a groundwater level is observed after the 24-hour period, the level will be noted and the borehole abandoned as described in the SOP entitled “SOP for Boring/Well Abandonment.” Boreholes not intended for monitoring well completion will be abandoned as described in the SOP entitled “SOP for Boring/Well Abandonment.”

Boreholes intended for monitoring well completion will be completed as described in the SOP entitled “SOP for the Completion of Groundwater Monitoring Well Boreholes.”

Upon completion of the drilling, the boring will be surveyed as per the procedures detailed in the SOP entitled “SOP for Surveying Sampling Locations,” and abandoned following the procedures detailed in the SOP entitled “SOP for Abandoning Boreholes/Wells.”

A-3

SOP FOR THE COMPLETION OF GROUNDWATER MONITORING WELL BOREHOLES

Prior to the drilling of soil borings, scheduled drilling sites will be cleared for utilities and structures by the environmental contractor or their subcontractors. A Utilities and Structures Checklist will also be filled out and signed prior to drilling and excavation activities. A copy of this form is included in Appendix B.

Drilling will be accomplished using either a direct-push rig (Geo-Probe® type), or hollow-stem auger or air/mud rotary or percussion drilling equipment or other applicable drilling rig capable of collecting continuous samples (split-spoon and/or dry core barrel) from the surface to the base of each hole. During drilling of soil borings, a continuous, descriptive, lithologic log will be prepared by a qualified geologist or geotechnical individual based on an examination of the split-spoon samples and soil cuttings. A copy of a blank boring log form is included in Appendix B. In the event that the soil boring can not be completed to a satisfactory depth, an alternative site may be chosen.

Continuous split-spoon samples will be obtained at each soil boring. The soil cores recovered in each split-spoon will be screened in the field for the presence of hydrocarbon constituents through visual examination and using a Photo-ionization Detector (PID). Soil samples will be selected based on staining, odor and elevated PID values and submitted to the laboratory for chemical analysis, according to the SOP entitled “SOP for Sample Target Zone and Sample Selection. These samples will be collected to assist in the identification and quantification of the vertical distribution of selected constituents that may be present in soils.

Borehole cuttings will be both continuously screened for volatile organic compounds (VOCs) and visually examined for signs of staining; those cuttings with either VOCs detected or heavy staining will be stockpiled separately from those soils that are VOC free.

Upon completion of the drilling, the groundwater monitoring well will be constructed according to the procedures detailed in the SOP entitled “SOP for Groundwater Monitoring Well Construction,” and surveyed according to the procedures detailed in the SOP entitled “SOP for Surveying Sampling Locations.”

Monitoring well completion detail figure

A-4

SOP FOR COMPLETING FIELD LOGS OF BORINGS

Borings installed on the Site, except those specifically excluded in the RI/FS Work Plan, are to be geologically logged during drilling activities. The following procedures are to be followed for the logging of borings at the Site:

1. As much information as possible is to be shown in the heading of each log. This includes, but is not limited to:
   - Project name and project identification number;
   - Identification of borehole;
   - Name of drilling company and lead driller;
   - Make, model, type, and size of drilling equipment used;
   - Start and end date of drilling
   - Name(s) of field personnel present;
   - Total depth of borehole; and
   - Depth to first encountered water.

2. Each log is to begin with a description of the surface, i.e., native, paved with asphalt, paved with concrete, and such. If any concrete is cut to open the hole, the thickness will be noted.
3. Every foot will be accounted for, with no gaps. If an interval is not sampled, it will be noted. If an attempt is made to sample an interval, but there is no recovery, it will be noted.
4. Complete construction details are to be detailed for each well on a standard well construction form (Appendix B). Construction details should include:
   - A description of the type and length of casing i.e., 20' of 2" inner diameter (id) Schedule 40 polyvinyl chloride (PVC) casing;
   - Length and depths of the top and bottom of the screened interval;
   - Screen slot size;
   - Depths of the top and bottom of the filter pack;
   - Filter pack materials and sand size;
   - Depths and types of bentonite seals;
   - Detail of the use of grout; and
   - Detail of the surface completion (i.e., stick up, flush mounted).

5. The number of bags of sand, bentonite, and grout used will be counted. These numbers will be compared daily with the driller's daily report.

*** The purpose of the field notes and logs is to document observations. They should not be used to state general interpretations (i.e. highly permeable, potential source, ugly).

A-5

SOP FOR SOIL DESCRIPTIONS

Soils logged during Site investigations (i.e. drilling activities) will be described in the following manner:

Soil descriptions will be recorded on a standard Boring Log Form, an example of which is presented in Appendix B. The following categories will be included in Boring Logs, in the listed order:

1. The most current Unified Soil Classification System (USCS) Group Symbol (see page 8).
2. Color (field moisture condition according to Munsell Soil Color Chart or geotechnical gauge).
3. Group Name.
4. Grain Size Range (unless describing a clay).
5. Shape/Angularity of Grains (unless describing a clay).
6. Consistency (SOFT, HARD, LOOSE, etc.), and plasticity for Clays and Silts.
7. Additional Observations (organic material, roots, construction debris, fossils, etc.).
8. Contacts (both sharp and gradational).
9. Moisture Content (DRY, MOIST, WET).
10. Odor with descriptions limited to NO ODOR, SLIGHT ODOR, or STRONG ODOR. No other adjectives to describe an odor will be used.
11. Staining.
12. The total depth of each hole.

In addition to the above items, first encountered groundwater and the static water level are also to be noted on the Boring Log Form.

Unified Soil Classification System

A-6

SOP FOR ROCK DESCRIPTIONS

Rock logged during Site investigations (i.e., drilling activities) will be described in the following manner:

Rock descriptions will be recorded on a standard Boring Log Form, an example of which is presented in Appendix B. The following categories will be included in Boring Logs, in the listed order:

Type of Rock

1. Rock Name (caps - formation name if known).
2. Color according to GSA rock color chart. If rock color chart is not available, use Munsell Soil Color Chart or geotechnical gauge and note so on the log.
3. for sedimentary rock, approximate percentages of fines, sand, and gravel. For example 30% fines, 70% very fine to fine sand.
4. SPACE HOLDER FOR STRATIFICATION.
5. Mineralogy, textural and structural features.

Physical Condition of Rock

6. Nature of the contact; sharp, gradational, or erosional. The log should show a solid line angled across the depth range of a gradational contact. Dashed line for inferred contacts.
7. Nature of fracturing including degree, minimum, maximum, and most common spacing.
8. Further describe fractures including:
    - 8.1 Presence or absence of fracture filling materials
        - 8.1.1 CLEAN - No fracture filling material
        - 8.1.2 STAINED - Coloration of rock only; no recognizable filling material
        - 8.1.3 FILLED - Fractures filled with recognizable material
    - 8.2 Separation of fracture walls
        - 8.2.1 CLOSED - 0
        - 8.2.2 VERY NARROW - 0-0.1 mm
        - 8.2.3 NARROW - 0.1-1.0 mm
        - 8.2.4 WIDE - 1.0-5.0 mm
        - 8.2.5 VERY WIDE - 5.0-25.0 (+) mm
    - 8.3 Fracture roughness classification
        - 8.3.1 SMOOTH - Appears smooth and is essentially smooth to the touch; may be slickensided.
        - 8.3.2 SLIGHTLY ROUGH - Asperities on the surfaces; they are visible and can be felt.
        - 8.3.3 MEDIUM ROUGH - Asperities are clearly visible and surface feels abrasive.
        - 8.3.4 ROUGH - Large angular asperities can be seen.
        - 8.3.5 VERY ROUGH - Near vertical steps and ridges occur on the surface.

Remember that fractures oriented 66-70 degrees to the core axis are suspect compressional/rotational shears induced by the coring process.

9. Hardness, described as follows:
    - 9.1 SOFT - Reserved for plastic material that can be easily molded with fingers.
    - 9.2 FRIABLE - Easily crumbled by finger pressure.
    - 9.3 LOW HARDNESS - Deeply gouged (1/8 inch to 1/4 inch) or carved with pocket knife.
    - 9.4 MODERATE HARDNESS - Readily scratched with knife; scratch leaves heavy trace of dust.
    - 9.5 HARD - Difficult to scratch with knife; scratch produces little powder and is often faintly visible.
    - 9.6 VERY HARD - Cannot be scratched with knife.
10. Weathering with respect to alteration, discoloration, and fracture condition described as follows:
    - 10.1 DEEPLY WEATHERED - Moderate to complete alteration of minerals; discoloration deep and through; all fractures extensively coated.
    - 10.2 MODERATELY WEATHERED - Slight alteration of minerals; discoloration moderate or localized and intense; thin coatings or stains.
    - 10.3 WEAKLY WEATHERED - No alteration of minerals; discoloration slight, intermittent and localized; few stains in fracture surfaces.
    - 10.4 FRESH - Unaltered; no discoloration; none to few stains on fractures.
11. Moisture (DRY, MOIST, or WET)
12. Presence of non-aqueous phase liquid (NAPL)
13. Odor with descriptions limited to NO ODOR, SLIGHT ODOR, or STRONG ODOR. No other adjectives to describe an odor will be used.
14. The total depth for each hole.

In addition to the above items, first encountered groundwater and the static water level are also to be noted on the Boring Log Form

A-7

SOP FOR BORING/WELL ABANDONMENT

Following installation and surveying (by either a professional surveyor or a field team using a global positioning system (GPS), soil borings that will not be converted to groundwater monitoring or extraction wells will be abandoned. In addition, project requirements and/or field conditions may require the occasional abandonment of constructed and/or partially constructed wells. The following minimum requirements for abandoning wells, and soil borings, as required by the Illinois Environmental Protection Agency (IEPA) and based upon previous investigations of the Site geology and hydrology, are presented below:

- All removable casing and or tubing will be removed.
- The hole will be filled, from the total depth to the top of all saturated zones, with cement, bentonite, or a mixture of the two. Expanding cement is preferred in contaminated zones, while bentonite pellets are suggested in uncontaminated, saturated zones. The hole is not to be backfilled with cuttings, regardless of whether they have been characterized as clean or dirty.
- A mixture consisting of cement and 2 to 5 percent bentonite will be used as a surface seal, from the top of all saturated zones to the ground surface.
- A mounded, expanding cement collar will be placed at the ground surface in order to divert surface drainage and prevent the intrusion of water into the abandoned hole.
- Borehole seals will be installed using the “tremmie pipe” method to ensure a proper seal.
- A standard abandonment form must be completed, and a State Abandonment Report will be filed with the proper agency.

Note: The above procedures are to be performed by a licensed driller, per applicable State requirements.

A-8

SOP FOR SURFACE SOIL/WASTE SOLIDS SAMPLING

Surface soils and non-soil solids will be sampled throughout the Site at locations specified in the RD Work Plan. Surface soil sampling will be preformed to assess the lateral extent of contamination in surface or near surface soils. Upon collection, surface soils/solids will be field screened for the presence of hydrocarbon constituents through visual examination and using a photo-ionization detector (PID), according to the procedures detailed in Section 3.0, then submitted to the laboratory for chemical analysis. These samples will be collected to assist in the identification and quantification of the vertical distribution of selected hydrocarbon constituents that may be present in soils, and provide information for RD.

The procedures listed below are to be followed for collecting surface soil and non-soil solid samples:

1. Record the sampling location and identification on a standard soil sampling form and the field log book.
2. Collect the sample from the predetermined depth. Samples will be collected using one of the following:
   - Decontaminated soil sampler;
   - Decontaminated stainless steel spoon; or
   - Decontaminated shovel.

3. Upon collection of the sample, immediately field screen each sample as detailed in Section 3.0.
4. Label necessary sample containers with the project number, sampling location, depth, date, time, analysis to be performed, and the initials of the sample personnel prior to or immediately after sampling each interval.
5. Either field-preserve the selected samples, collect them in Encore® samplers, or prepare them according to the sample bottle requirements listed in Table 4-2. Handle and submit the samples as described in the applicable SOP.
5. Describe the lithology of the sampling location according to the procedures detailed in the logging and soil and rock description SOPs.
6. Decontaminate sampling equipment as per the procedures in the applicable SOPs.
7. Dispose of wastes according to the procedures detail in Section 6.0.

A-9

SOP FOR SOIL SAMPLE TARGET ZONE AND SAMPLE SELECTION

The remedial Design (RD) field sampling effort will generate numerous soil samples. Field screening will be conducted on the soil samples in order to identify subsets of samples that require further analysis conducted by a laboratory. This SOP describes the rationale for field screening and selection of samples to be transferred to an analytical laboratory.

The determination of the sampling intervals and types of samples collected will differ depending on the location of the boring. The subsurface investigation can be divided into two groups:

1. Borings within the RCRA outside container storage area (OSA).

2. Borings located outside the OSA.

Determination of Target Sample Zones

Borings located within the OSA

The eight borings that are located within the OSA will require a soil sample submitted to the laboratory for:

- Every two foot interval from the ground surface to the water table (approximately 30 feet below ground surface).
- Sample selection within each two foot interval will be determined by PID screening. PID headspace analysis (samples allowed to equilibrate in a plastic bag for approximately 10 minutes).
- If there are no elevated PID readings the sample shall be collected on the basis of visual staining.
- If no samples in the interval appear to be impacted, one sample must be selected at the discretion of the sampler to send to the laboratory for confirmatory analysis.
- Samples will be analyzed for:
    - VOCs
    - DRO
    - RCRA TCLP metals

Borings located outside of the OSA

The remaining twenty-two boring locations outside of the OSA will require a soil sample sent to the laboratory for:

- Up to two samples collected from the interval between the ground surface and the water table (approximately 30 feet below ground surface).
- Sample selection within the interval will be determined by PID screening. PID headspace analysis (samples allowed to equilibrate in a plastic bag for approximately 10 minutes).

- If there are no elevated PID readings the sample shall be collected on the basis of visual staining.
- If the highest PID reading and staining are in two different intervals then a sample will be collected from the point of the highest PID reading and a sample will be collected from the point of the greatest staining.
- If no samples in the interval appear to be impacted, one sample will be collected at the water table interface (from just above the saturated zone) to send to the laboratory for confirmatory analysis.
- Samples will be analyzed for:
    - VOCs
    - DRO

See the appropriate SOPs for details on: Conducting Field Screening Using a PID (A-16), Subsurface Soil Sampling (A-14), Quality Control Sampling (A-26).

Samples collected for possible analysis but which do not meet the laboratory selection criteria may be disposed of according to the procedures detailed in Section 6.0

A-10

SOP FOR HYDAC™ TEMPERATURE MEASUREMENT

Summary of Method and Equipment

The temperature probe built into the Hydac™ sample cup will be used to measure groundwater temperature, and will provide the basis for setting the Hydac™ temperature adjustment knobs.

Procedure

The Hydac™ measurement switch should be toggled to the 'Temperature' position. Groundwater will then be decanted from either the disposable bailer or the pump sample port tube into the Hydac™ sample cup, while the Hydac™ read-out switch is depressed. Groundwater will continue to be decanted into the sample cup until the reading stabilizes, in order to minimize the influence of ambient air temperature on the measurement. Following temperature measurement, conductivity and pH measurements will be taken.

A-11

SOP FOR HYDAC™ CONDUCTIVITY MEASUREMENT

Summary of Method and Equipment

The conductivity probe built into the Hydac™ sample cup will be used to measure groundwater conductivity.

Procedure

Prior to pH measurement, the Hydac™ measurement switch is to be toggled to the 'Conductivity' position. The conductivity units selector should be set to the 'x 1000' setting. The conductivity is measured by depressing the Hydac™ read-out switch and waiting for the conductivity measurement to stabilize. Following this reading, the groundwater pH will be recorded as below.

A-12

SOP FOR HYDAC™ pH MEASUREMENT

Summary of Method and Equipment

The pH of a sample is measured electrometrically using both the Hydac™ sample cup and the attached Hydac™ pH electrode probe. Groundwater should be analyzed as soon as possible following temperature and conductivity measurement to avoid changes in pH caused by changes in the chemical equilibrium of the sample.

Calibration Procedure

Prior to each daily use, the pH of the Hydac™ is to be calibrated as follows:

1. Portions of pH 4.0 and 7.0 standards will be placed into clean containers;
2. The attached electrode will be placed into the pH 7.0 solution. After setting the Hydac™ temperature adjustment knob to the approximate temperature of the samples to be screened, the pH will be read and adjusted to read 7.0, using the 'Zero' adjustment knob;
3. The electrode will be removed from the solution and rinsed with distilled water, and then placed into pH 4.0 standard. The pH will again be read and adjusted to read 4.0, with the 'Slope' adjustment knob;
4. The electrode will then be again removed and rinsed with distilled water, and re-inserted into the pH 7.0 standard and adjusted to read 7.0. Steps 2 through 4 will then be repeated until the Hydac™ reads both standard pH solutions to within 0.05 standard units. The final readings, date, and time will then be recorded in the Hydac™ calibration log.

Procedure

Following groundwater temperature and conductivity readings, the attached Hydac™ pH probe is to be inserted into the Hydac™ sample cup, and gently swirled within the groundwater. The Hydac™ read-out button will then be depressed and held down until the pH reading stabilizes. This value will then be recorded.

A-13

SOP FOR HYDAC™ METER OPERATION

The Hydac™ meter is a multi-function instrument used to measure the pH, conductivity, and temperature of an aqueous sample. The following procedures will be used to operate the Hydac™ meter during sampling activities:

1. The Hydac™ will be calibrated according to manufacturers' specifications. A minimum of two standards will be used when calibrating for pH (see SOP for Hydac™ pH Measurement);
2. A minimum of two standards and a blank (distilled or deionized water) will be used when calibrating for conductivity;
3. Both the Hydac™ sample cup and the pH probe will be thoroughly decontaminated with an Alconox™ or similar low-phosphate cleaning agent solution, and rinsed with de-ionized water prior to collecting groundwater measurements from each well or sampling station;
4. As outlined in Section 3.0, temperature, conductivity, and pH will be measured immediately following each well purge volume, or following the one-gallon sample port purge in operating groundwater extraction/recovery/production wells. Groundwater will be decanted into the Hydac™ sample cup for measurement;
5. Prior to insertion of the pH probe into the Hydac™ sample cup, temperature and conductivity measurements, in that order, will be recorded. pH will then be recorded;
6. Readings will be recorded to three significant figures for pH and conductivity, and two significant figures for temperature;
7. The Hydac™ sample cup and pH probe will be thoroughly rinsed between readings at each individual well or sampling station; The equipment will be decontaminated, as in Step 3, between wells or sampling stations;
8. The Hydac™ will be re-calibrated prior to each day of use, and again at the end of each day, in order to verify that it kept its calibration throughout the day. Abnormalities will be thoroughly documented and corrected by qualified personnel; and
9. The temperature adjustment knobs on the Hydac™ will be set to the approximate temperature of the samples to be screened prior to initial Hydac™ use, and adjusted throughout the day as necessary.

A-14

SOP FOR FIELD SCREENING USING A PHOTO-IONIZATION DETECTOR

A photo-ionization detector, such as a Rae Systems™ MiniRae™, will be used to field screen soil and non-soil solids for the presence of volatile organic compounds (VOCs). The following procedures are to be followed for the use of the photo-ionization detector (PID), after the initial core-barrel VOC screening described in Section 3.0.

As a first step in PID field screening, immediately reserve two representative portions of each soil sample;

- One portion (for possible Encore® sampling or field preservation and laboratory analysis) should be used to fill containers supplied by the analytical laboratory. Note: the number and type(s) of containers will be location-specific. Those containers should be labeled and stored in a cooler on ice.

- The other portion (for field screening) should be placed into an appropriately sized resealable Ziploc® or equivalent bag. Following bagging, the steps listed below should be followed:

    1. Seal and label the bag with the borehole identification and the depth of the sample.
    2. Transport the bagged soil to the on-Site field laboratory. Allow the bag to equilibrate for approximately ten minutes.
    3. Insert the probe tip of the PID into the bag. Obtain a measurement of total VOCs using the PID.
    4. Ensure the PID has been calibrated according to the procedures in the operation manual. In addition, calibrate the PID anytime there is reason to question the PID readings. Note calibrations in the field logbook and in daily, instrument calibration log (Appendix B).

Calibration instructions for the MiniRae 2000:

- Press Mode and N/- for 3 seconds simultaneously
- Press Y/+ fresh air zero
- Press Y/+ to zero
- Wait
- Press
- Press Y/+ fresh…then continue
- Press N/- span
- Press Y/+ after the screen shows apply gas
- Press Y/+
- Wait
- Press Y/+ to accept calibration
- Press Mode twice
- Ready
- Press Y/+
- Proceed with measuring

A-15

SOP FOR METHOD 5035: FIELD PRESERVATION, COLLECTION, AND HANDLING INSTRUCTIONS FOR VIALS

Method 5035 requires ample preservation in the field at the point of collection. The preservative used for the low concentration soil method (0.5 to200 ug/kg) is sodium bisulfate and the preservative used for the medium/high concentration soil method (>200 ug/kg) is methanol. This field collection and preservation procedure is intended to prevent loss of VOCs during sample transport, handling, and analysis. The holding time for VOC analysis is 14 days.

Materials

- 2 de-ionized water preserved pre-weighed vials for low level analysis with magnetic stir bar.
- 2 sodium bisulfate preserved pre-weighed vials for low level analysis. These vials will also contain a small magnet stir bar.
- 1 methanol preserved pre-weighed vial for medium-high level analysis
- 1 non-preserved 4 oz container for percent total solids determination
- 1 syringe
- 1 Power Handle for collecting samples with syringe

Instruction for Sample Collection

1. The blue plate should be in place on the Power Handle (flanges should be pointing to the round end of the handle). A 5g sample will be collected when the plate is in place.

2. Clip syringe into the Power Handle.

3. Using the Power Handle, push the syringe into the soil to collect 5g sample.

4. Unclip syringe from Power Handle and extrude 5g sample into vial.

5. Repeat process for each additional vial.

6. A single syringe can be used to collect sample aliquots for each of the three vials.

7. Mark each sample container with your sample identification. Do not add any additional labels or tape to the pre-tared vials. Store samples at 4^{o}C. VOCs must be analyzed within 14 days of collection.

8. A fourth container needs to be submitted to the laboratory for percent total solids determination. Fill the container provided to capacity. If extractable organic analyses, i.e., semi-volatiles, PNAs, or pesticides/PCBs will be performed, the fourth container should be a 4-oz. glass jar.

Note: Methanol is a flammable substance. If samples will be shipped to the laboratory via couriers such as UPS or Federal Express, DOT labeling requirements must be met.

To meet DOT labeling requirements, the following statement must be affixed to the package: "This package conforms to the conditions and limitations specified in 49CFR 173.4." The CFR reference is 49 – Transportation, Part 173 – Shippers, General Requirements for Shipments and Packaging, Section 173.4 – Small Quantity Exceptions. In our opinion, the pertinent requirements of this reference are as follows:

- The maximum quantity of material per inner receptacle is limited to thirty (30) mL.
- Each inner receptacle is securely packed in an inside packaging with cushioning and absorbent material. The inside packaging cannot react chemically with the material and needs to be capable of absorbing the entire contents of the receptacle. *(Note: the foam container in which the vials are placed meet these requirements.)*
- The inside packaging is securely packed in a strong outside packaging. *(Note: the cooler meets this requirement.)*
- The gross mass of the completed package does not exceed 64 pounds.

An alternative to field preservation is the use of EnCore samplers (or equivalent) as collection and storage devices. Samples collected in this device must be preserved by the laboratory or analyzed within 48 hours of collection.

Please call us if you have questions concerning these requirements.

A-16

SOP FOR SUB-SURFACE SOIL SAMPLING

Continuous split-spoon samples will be obtained at each soil boring. The soil cores recovered in each split-spoon will be screened in the field for the presence of hydrocarbon constituents through visual examination and using a photo-ionization detector (PID), according to the procedures detailed in Section 3.0. Soil samples will be selected based on the SOP entitled "SOP for Sample Target Zone and Sample Selection" and submitted to the laboratory for chemical analysis. These samples will be collected to assist in the identification and quantification of the vertical distribution of selected hydrocarbon constituents that may be present in soils, and provide information for the RI/FS and baseline risk assessment.

The procedures listed below are to be followed for collecting Site sub-surface soil samples:

1. Record the borehole location and identification on a standard soil sampling form and the field log book.
2. Upon recovery of the sampler from the borehole, open and immediately field screen each core as detailed in Section 3.0.
3. Based on the results of the field screening, the SOP entitled "SOP for Sample Target Zone and Sample Selection", collect the appropriate number of bagged and jarred samples. Bag samples are to be placed within new, appropriately sized Zip-Lock™ or equivalent plastic bags. Jar samples are to be placed within appropriately sized (based on the proposed analysis to be run, cross-referenced with the sample bottle requirements listed in Table 4-2) new glass sample jars, and closed tightly.
3. Label necessary sample containers with the project number, borehole number, depth interval, date, time, analysis to be performed, and the initials of the sample personnel prior to or immediately after sampling each interval. (see Section 5.0)
4. Select soil samples to be submitted for laboratory analysis based on the SOP entitled "SOP for Sample Target Zone and Sample Selection". Either field-preserve the selected samples, collect them with Method 5035 syringe samplers, and/or prepare them according to the sample bottle requirements listed in Table 4-2. Handle and submit the samples as described in the applicable SOP.
5. Describe the lithology of the core according to the procedures detailed in the logging and soil and rock description SOPs.
6. Decontaminate sampling equipment as per the procedures in the applicable SOPs.
7. Dispose of wastes according to the procedures detail in 6.0.

A-17

SOP FOR WELL DEVELOPMENT

After completion, each well will be developed by surging and/or bailing a minimum of three well (i.e., borehole) volumes prior to sampling. Appropriate well development will help maximize yields and minimize the turbidity of water obtained during sampling. Well development will terminate when both the groundwater turbidity does not decrease after five casing volumes have been purged, and when pH, electrical conductivity, and temperature have stabilized to within +/- 0.2 standard units, 10%, and 2.0 degrees F, respectively.

Well development activities and measurements will be record on a standard development form. A blank copy of this form can be presented in the attached form.

Groundwater removed during development will be containerized and disposed of as detailed in Section 6.0.

A-18

SOP FOR GROUNDWATER SAMPLING FROM OBSERVATION/MONITORING WELLS

The following protocol has been developed to obtain groundwater samples that provide representative chemical quality information. The groundwater sampling procedure will consist of the two steps described below: an initial purging of the well, followed by the collection of samples.

Well Purging

Wells will be purged prior to sampling. Purging will consist of the following steps:

1. Identify the well and record its designation on a both a standard Groundwater Sampling Field Data Sheet (Appendix A-17) and the field log book.
2. Unlock the well and remove the well cap, placing in such a way as to prevent it from coming into contact with any contaminated surfaces.
3 Collect groundwater and non-aqueous phase liquid (NAPL) level measurements as described in the SOP entitle "SOP for Collecting Groundwater Level and NAPL Level Measurements," if this procedure has not already been completed. If NAPL is present and the elevation of the water is to be determined, correct the water level, considering the thickness and the density of the overlaying NAPL. **If NAPL is present, do not sample the well groundwater.** See the SOP entitled "SOP for NAPL Sampling."
   Record applicable information on a standard Groundwater Level Measurement Form and in the field logbook.
4. Compute the volume of water in the well based on the total depth of the well measured, the diameter of the well casing, and the height of the water column in the well.
5. Measure the total depth of the well if required. A comparison of this measured depth with the depth of the well at the time the well was completed will indicate if significant sediment accumulation is occurring in the well.
6. Remove three to five times the volume of standing water in the well, using either a bailer, centrifugal pump, peristaltic pump, or a submersible pump, depending on the depth to water and project specific requirements.

   6.1 In cases where a pump is used, use dedicated or new tubing in each well. If a generator is needed, place it downwind of the well. The submersible pump will be cleaned inside and out according to the "SOP on Decontamination" immediately before placement in the well. Make sure the pump is running before it enters the well, in order to prevent introduction of the remnants of the final distilled water rinse into the well.

   6.2 Position and maintain the intake opening of the pump line or pump impellers just below the water to ensure that the well is properly flushed. If there is a decrease in the well's water level as a result of pumping, the intake line should be lowered as needed. In no case should the pump be placed lower than ten feet below the static water level measured in the well. Pump discharge should be used to limit groundwater drawdown in the well.

   6.3 If the well has been purged or developed recently, the water level (the volume of water in the casing) may not have yet recovered or returned to

its static condition. This does not require a change in the evacuation procedures outlined above. Although the actual column of water in the casing under such conditions is less than normally encountered, the removal of three to five times this volume is normally sufficient to provide samples for analysis that are representative of water from the surrounding formation.

6.4 Following the removal of each casing volume of water from the well, field screen the groundwater for pH, conductivity, and temperature, according to the applicable SOPs.

6.5 The purging will be considered complete when the following qualifications are met:

- A minimum of three casing volumes of groundwater have been removed from the well, and;
- The final two measurements of pH, conductivity, and temperature are within 0.2 standard units, 10%, and 2.0 degrees F, respectively.

7. If the well goes dry prior to the removal of the third casing volume, note this, and the number of gallons removed from the well, on the sampling sheet and in the field log book. Gauge the well groundwater level on appropriate intervals to measure recharge. Upon the well reaching 80 percent recovery of its initially recorded static water level, repeat step 6. If the well again goes dry, repeat step 7. If the well goes dry following three consecutive purges, continue on to step 1, Groundwater sample collection procedures. If the well does not reach 80 percent recharge within 24 hours following the first purge, purge the well dry again and sample the next appearance of water. If there is not enough water to collect a full set of samples, note the well as dry and discontinue sampling efforts for that well. Enter "dry" on the groundwater sampling field sheet and in the field logbook for that well.
8. As noted in Section 3.0 disposable nitrile gloves are to be worn and changed between each well, in order to prevent introduction of external contaminants into the groundwater or groundwater sample, and minimize the chance of cross-contamination between wells. Gloves should also be changed if they become visibly stained with NAPL or contaminated materials.
9. Contain and dispose of purge/development water as specified in Section 6.0.

Groundwater sample collection procedures

Following purging activities, wells are to be sampled using the procedures listed below. Unless directed to do otherwise by the Site-specific work plan, collect water samples using disposable, polyethylene bottom-filling bailers. If the well was purged with a disposable bailer, use the same bailer for sampling.

1. Gauge the well with the interface probe (IP), and determine if the well has reached 80 percent or greater recharge. If the well has not reached 80 percent recharge, gauge the well on appropriate intervals to measure the recharge. Once the well reaches 80 percent recharge, continue on to step 2. If the well does not reach 80 percent recharge within 24-hours, note this and sample the well. If there is not enough water to collect a full set of samples, note the well as dry and discontinue sampling efforts for that well. Enter "dry" on the groundwater sampling field sheet and in the field logbook for that well.

2. Lower the bailer into the well slowly and gently, in order to minimize disturbances to the water table and to avoid aerating the sample.
3. Remove the bailer carefully and gently pour the water sample into the sample containers to minimize the volatilization of organic compounds.
   - Collect duplicate samples directly from the bailer with each sample receiving equal amounts to ensure sample uniformity.
   - If a bailer will not hold the volume of water necessary to immediately fill the sample containers, each container will receive an equal amount from each full bailer.
   - During the sampling of such wells, cap partially filled sample bottles and keep out of sunlight, as delays in obtaining adequate sample volume could otherwise jeopardize the representativeness of the samples.
4. Once the samples have been collected, prepare and preserve them in accordance with recommended USEPA procedures and the Site specific work plan.
5. In general and whenever possible, collect groundwater (as well as surface water, soils, and sediment samples) with the intent to first fill sample containers designated for volatile organic analysis. Follow this by filling containers for semi-volatile organic analyses, metals analyses, and major cation/anion analyses.
6. Upon completion of sampling, cover and lock the well, and remove the sampling materials from around the well.
7. Disposable items, such as bailers, rope, cleaning rags, and gloves, should be disposed of as per the guidelines in Section 6.0.

Well Purging and Groundwater Sampling Equipment

The following field equipment is required for well evacuation and sampling:

Field book, pens, marking pens, and labels.
Kim-wipes, disposable gloves.
NAPL/water level indicator.
Distilled water, sprayer.
Alconox® or equivalent low-phosphate cleaning agent solution.
Disposable polyethylene bailers, or centrifugal, peristaltic, and/or submersible pumps, with appropriate tubing.
Tools for opening wells.
Keys for well locking caps.
Graduated pail and 5-gallon purge buckets.
Coolers and ice.
Hydac ™ meter.
Purge water container (i.e., 200-gallon tank).
Bailer cord.
Chains-of-Custody and field forms.
Sample containers.

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SOP FOR GROUNDWATER SAMPLING FROM RECOVERY WELLS

Groundwater recovery/extraction wells that **do not** have dedicated pumps in-place will be sampled according to the procedures detailed in the SOP entitled "SOP for Groundwater Sampling from Observation/Monitoring Wells."

In groundwater recovery/extraction wells with dedicated pumps in-place, two separate groundwater purging and sampling techniques will be utilized. In all cases, the wells will be gauged according to the procedures detailed in the SOP entitled "SOP for Collecting Groundwater Level and NAPL Level Measurements" prior to sampling.

Well Purging

1. In cases when the dedicated groundwater recovery/extraction pump is in operation, it is unnecessary to purge three to five casing volumes from the well. Rather, the pump groundwater discharge manifold valve is to be shut off and the sample port valve is to be opened. Approximately one gallon of groundwater is then to be purged though the well sample port, in order to clear the port and sample hose of any contaminants or debris. Temperature, pH, and conductivity readings are then to be measured and recorded according to the procedures detailed in Section 3.0. The sample is then to be collected according to the **Groundwater Sample Collection Procedures** listed below, from one pump stroke discharge, if possible.

2. In cases where the dedicated pump is not operating, it will be necessary to purge three to five casing volumes of groundwater through the pump discharge line. Calculate the correct purge volumes as per the applicable procedures described in the SOP entitled "SOP FOR GROUNDWATER SAMPLING FROM OBSERVATION/MONITORING WELLS". Groundwater screening and sampling will then follow the procedures listed above in Step 1.

Groundwater Sample Collection Procedures

Samples from recovery/extraction wells are to be decanted into the appropriate sample containers, as detailed in Table 4-2, through the well sample port and any associated dedicated sample tubing. In addition, the procedures listed below are to be followed:

- Collect duplicate samples directly from the bailer with each sample receiving equal amounts to ensure sample uniformity.
- If a single pump stroke will not supply the volume of water necessary to fill all the sample containers, each container will receive an equal amount from each pump stroke.
- During the sampling of such wells, cap partially filled sample bottles and keep out of sunlight, as delays in obtaining adequate sample volume could otherwise jeopardize the representativeness of the samples.
- Once the samples have been collected, prepare them in accordance with recommended United States Environmental Protection Agency (USEPA) procedures and the Site specific work plan.
- In general and whenever possible, collect groundwater with the intent to first fill

sample containers designated for volatile organic analysis. Follow this by filling containers for semi-volatile organic analyses, metals analyses, and major cation/anion analyses.

- Disposable items, such as bailers, rope, cleaning rags, and gloves, should be disposed of as per the guidelines in Section 6.0.

A-20

MANUFACTURERS OPERATING INSTRUCTIONS FOR THE USE OF A THERMO GAS TECH INNOVA-ST (STANDARD MULTI-GAS MONITOR)

Page 1 of Op Inst

Page 2 of Op Inst

Page 3 of Op Inst

Page 4 of Op Inst

Page 5 of Op Inst

A-21

SOP FOR COLLECTING LNAPL SAMPLES

1. Gauge the well with an interface probe as describe in the SOP entitled “SOP for Groundwater Level and non-aqueous phase liquid (NAPL) Level Measurements.”
2. Record the depth to light non-aqueous phase liquid (LNAPL), if present, and the depth to groundwater.

Do not submit a liquid sample used for field screening i.e., a sample containing SUDAN IV dye to the laboratory.

1. Collect as much LNAPL as possible. To avoid cross contamination with other sample locations, you must use:
   - New disposable gloves.
   - A new disposable bailer.
   - New nylon cord.

2. A minimum of **10 ml** is required for analysis. Note: It is better to obtain a smaller sample volume with no water than a larger sample with LNAPL and water mixed.
3. Decant the LNAPL into clean 40ml VOA vials. Note: Typically, 40ml VOAs, without preservative, will be sent especially for this purpose. Also, the size and number of containers may vary on a project specific basis
4. **Do not fill the VOA more than 80%. In other words, less than 30ml per VOA**. This is to allow for thermal expansion, expansion resulting from changes in altitude and ensure the NAPL falls below hazardous waste shipment limits.
5. Label the LNAPL sample according to project specific requirements.
6. Put all LNAPL samples on a separate chain-of-custody, marked for analysis by “Simulated Distillation ASTM Method D3328-90 plus Specific Gravity,” and pack in a separate container, as described in the SOP entitled “SOP Handling and Shipping NAPL Samples” found below.

A-22

SOP FOR WATER, SOIL, AND WASTE SOLID SAMPLE HANDLING AND TRANSPORT

The interior of the sampling coolers and exterior of soil and groundwater sample containers will be cleaned with deionized water prior to packing samples for transport to the laboratory. Soil, non-soil solid, and groundwater sample packing will follow the general procedures outlined below:

1. Glass sample containers (i.e. volatile organic analysis (VOA) vials, soil jars) and Encore™ samplers will be placed into bubble-wrap bags following labeling, and sealed;
2. Sample containers will be sealed inside an appropriately sized Zip-lock™ or equivalent baggie;
3. VOA vials will be stored inverted, per United States Environmental Protection Agency (USEPA) regulations;
4. Drain plugs on the sample coolers (if present) will be secured, and packing material added to the coolers to protect the VOA vials;
5. The sample cooler will be lined with a new, sealed plastic bag to prevent any ice melt from leaking out of the cooler;
6. Water, soil, and non-soil solid sample containers will be placed on ice in the sample cooler;
7. The remainder of the sample cooler will be filled with packing material to prevent sample containers from making contact with each other or the sample cooler walls;
8. The cooler inner-liner plastic bag will be sealed with packaging tape;
9. Chain-of-custody forms will be placed in a Zip-lock™ bag (or equivalent) that will be sealed within the sample cooler prior to transport;
10. The cooler will be properly closed and sealed with packaging tape, and;
11. Sample coolers will either be hand delivered to the laboratory by field personnel, or transferred to an appropriate shipping service (ex. FedEx™ or UPS™) for delivery to an out-of-town laboratory.

A-23

SOP FOR DECONTAMINATION PROCEDURES

Reusable field instrumentation and sampling equipment will be decontaminated prior to its first use, and between each well/sampling location in which it is used. Two types of decontamination procedures will be employed, depending on the level of visual or otherwise known contamination to which the instrumentation is exposed. Pre-use decontamination will follow the first decontamination protocol listed below.

Instrumentation and equipment that has no signs of visible non-aqueous phase liquid (NAPL), and which has not come in contact with a known source of NAPL, will be decontaminated in the following manner:

1. The instrumentation and sampling equipment will be thoroughly washed with a mixture comprised of approximately 2-tablespoons of Alconox® (or similar low phosphate cleaning agent) per 1-gallon of de-ionized water. A stiff bristle scrub brush will be used if necessary to provide thorough cleaning.
2. The instrumentation/equipment will be triple-rinsed with unused de-ionized water.

Instrumentation/equipment that either has signs of visible NAPL or has come in contact with a known source of NAPL will be decontaminated in the following manner:

1. The instrumentation/equipment will be thoroughly rinsed with tap water to remove sediment and debris.
2. The instrumentation/equipment will be completely and evenly sprayed with laboratory-grade hexane. ***Proper precautions **must** be utilized when using hexane. Use only in adequately ventilated areas, and do not inhale the vapors. FOLLOW GUIDELINES CONTAINED IN THE HEXANE MSDS.***
3. The instrumentation/equipment will be completely and evenly sprayed with laboratory grade methanol.
4. The instrumentation and sampling equipment will be thoroughly washed with a mixture comprised of approximately 2-tablespoons of Alconox® (or similar low phosphate cleaning agent) per 1-gallon of de-ionized water. A stiff bristle scrub brush will be used if necessary to provide thorough cleaning.
5. The instrumentation/equipment will be triple-rinsed with unused de-ionized water.

The effectiveness of the above decontamination procedures will be demonstrated through the periodic use of equipment blanks. A more detailed discussion of the proposed use of equipment blanks is provided in Section 4.0.

Drill rigs or Geoprobes® used on Site will be thoroughly decontaminated prior to their arrival at the Site and prior to initiation of any drilling activities. The rig and its equipment will be thoroughly examined to ensure that there are no significant fuel, hydraulic fluid, transmission oil, and/or motor oil leaks that could create a condition not previously in existence or exacerbate an existing condition.

Once the rig and its equipment (including split-spoon soil samplers and associated drill rods used to obtain soil samples during the drilling of soil borings or monitoring wells) have been thoroughly cleaned and inspected, subsequent decontamination efforts will focus only on those pieces of equipment which actually come into contact with soils or groundwater. No petroleum

hydrocarbon based lubricants will be allowed on the drill stems or associated connections. Both the initial comprehensive cleaning of the rig and subsequent decontamination procedures will be performed using either steam cleaning equipment or high-pressure hot water/detergent wash. In addition, casing centralizers and casing handling equipment, if used, will be cleaned prior to use in the construction of monitoring wells.

Decontamination wash solutions and rinsate will be collected and containerized in 5-gallon buckets, 55-gallon drums, or poly tanks. The collected rinsate will be disposed as described in Section 2.0.

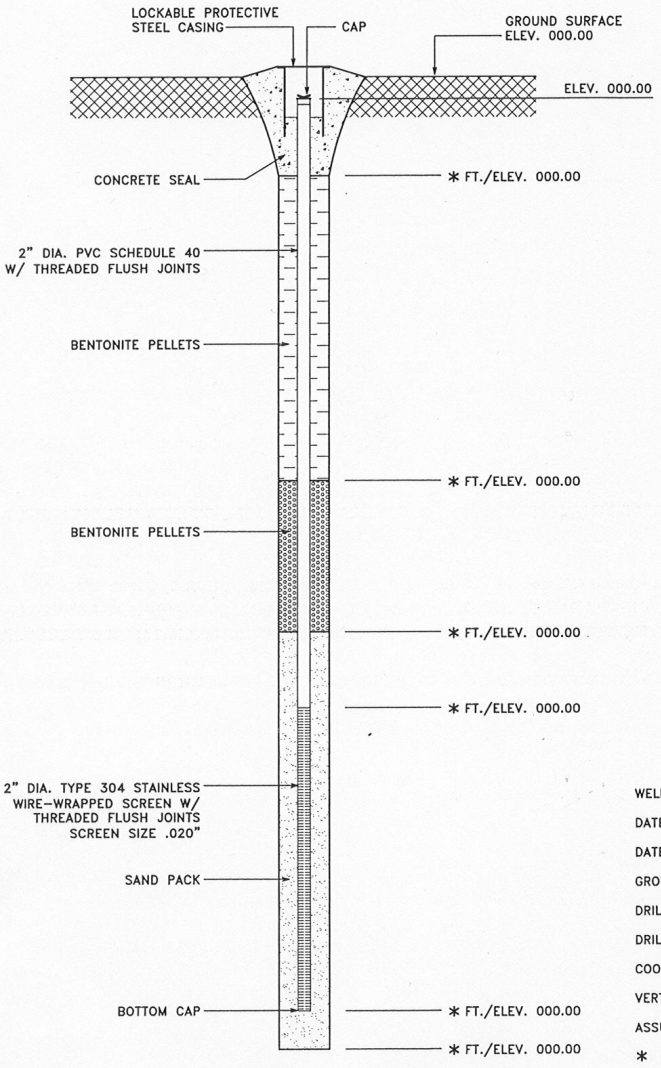
A-24

SOP FOR LNAPL SAMPLE HANDLING AND TRANSPORT

1. To ship volatile organics analysis (VOAs) containing non-aqueous phase liquid (NAPL), the following are needed:
   - **New** paint cans (from a hardware store). One can for each VOA to be shipped will be required.
   - Vermiculite or kitty litter.

2. Place each VOA into a small Zip-Lock™ bag.
3. Use the vermiculite or kitty litter to pack the bagged VOAs into the paint cans. Firmly attach the paint can lids. The key is to have enough absorbent material in the paint can to insulate the VOAs from shocks and to absorb the NAPL if a VOA is damaged. Paint cans are available in various sizes. As mentioned previously, match the number of paint cans to the number of VOAs.
4. Pack the paint cans into a cooler. Use packing material to fill in the space around the cans.
5. Place chain-of-custody into a Zip-Lock™ bag and on top of the cans.
6. At least one label stating: "This Package Conforms to Conditions and Limitations Specified in 49 C.F.R. 173.4" must be attached to the outside of the cooler.
7. ***At least two arrow keys*** pointing towards the top of the cooler must be attached to the outside of the cooler.
8. UPS will accept coolers/packages that are marked as described in steps XI and XII. Federal Express will not accept such packages.
9. NAPL samples must be sent to the appropriate analytical laboratory.

***** The shipping instructions listed above are extremely important. Failure to have the combination of an inner container (the VOA), an outer container (the paint can), absorbent material (the vermiculite/kitty litter), and the label and direction arrows mentioned in steps 6 and 7 could result in government fines of $40,000 per violation.**



WELL NUMBER _____

DATES DRILLED _____

DATE INSTALLED _____

GROUND WATER ELEV.

DRILLER _____

DRILLING METHOD _____

COORDINATES _____

VERTICAL DATUM: _____

ASSUMED _____ U.S.G.S. _____

* DEPTH BELOW _____

MONITORING WELL COMPLETION DETAIL – EXAMPLE

SECOR
International Incorporated

PROJECT TITLE
LOCATION
SITE LOCATION

JOB NO. 000.00000.000 FIGURE 0

DRAWING FILE INFO DATE

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION SYSTEM						
IDENTIFICATION PROCEDURES					SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS	GRAVELS > 50% of coarse fraction is larger than No. 4 sieve	CLEAN GRAVELS	Wide range in grain size and substantial amounts of all intermediate particle sizes		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			Predominantly one size or a range of sizes with some intermediate sizes missing		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	Non-plastic fines (see ML below for identification procedures)		GM	Silty gravels, poorly graded gravel-sand-silt mixtures
			Plastic fines (see CL below for identification procedures)		GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
	SANDS >50% of coarse fraction is smaller than No. 4 sieve	CLEAN SANDS	Wide range in grain size and substantial amounts of all intermediate particle sizes		SW	Well-graded sands, gravelly sands, little or no fines
			Predominantly one size or a range of sizes with some intermediate sizes missing		SP	Poorly graded sands, gravelly sands, little or no fines
		SANDS WITH FINES	Non-plastic fines (see ML below for identification procedures)		SM	Silty sands, poorly graded sand-silt mixtures
			Plastic fines (see CL below for identification procedures)		SC	Clayey sands, poorly graded sand-clay mixtures
FINE GRAINED SOILS		DRY STRENGTH	DILATANCY	TOUGHNESS	FOR FRACTION SMALLER THAN No. 40 SIEVE	
	SILTS AND CLAYS LL<50	None-slight	Quick-slow	None	ML	Inorganic silts and very fine sands, silty or clayey fine sands with slight plasticity, rock flour
		Medium-high	None-very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Slight-medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity
	SILTS AND CLAYS LL>50	Slight-medium	Slow-none	Slight-medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		High-very high	None	High	CH	Inorganic clays of high plasticity, fat clays
		Medium-high	None-very slow	Slight-medium	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture			PT	Peat and other highly organic soils

Start Up

WARNING

Perform all procedures in a "fresh air" environment (environment known to be free of combustible and toxic gases and of normal oxygen content).

1. Press and hold the **ON/OFF** button for one second. Once **WARMUP COMPLETE** is shown, hold down the **AIR** button for 3 seconds to adjust the Innova to "fresh air" readings ("**demand zero**"). Once **DONE** is shown, the instrument is in the Normal Operation Mode.
2. If applicable, verify that the display reads **0** in the LEL, Toxic 1, and Toxic 2 fields, and **20.9%** in the O_2 field. Any unused channel is blank (if applicable).
3. If applicable, confirm normal operation of the O_2 section. Blow into the probe until the display reaches 19.5%, triggering the alarm.
4. Place the probe into the area to be monitored.

WARNING

Never "demand zero" in a non-fresh air environment.

Operation

In normal operation, your Innova monitors the environment and displays current gas or oxygen concentrations. You can press any button in dimly-lit or dark monitoring area to illuminate the LCD display.

Operator Indications and Suggested Actions

When conditions cause the Innova to reach a preset warn or alarm level, the condition is sensed, and your Innova alerts you with audible and visual indications. Descriptions of common indications, probable (or possible) cause(s), and recommended actions are covered in this section.

CAUTION

Always follow established procedures for an alarm condition. If procedures do not exist, please establish an appropriate plan of action.

Warn Indication

A warn indication occurs when a preset warn level is reached.

Visual/audible indications: The reading of the applicable channel blinks. The red LEDs blink and the buzzer sounds in an even, slow pulsing pattern.

Action: Your Innova resets its alarms when normal gas levels return (if at the default setting **AUTO RESET**), or press **ON/OFF** button momentarily if the alarm latch (**MANUAL RESET**) has been enabled.

ALWAYS investigate the cause of any warn indication.

Alarm Indication

An alarm indication occurs if the gas concentration continues to increase (or decrease) to a preset alarm level.

Visual/audible indications: The reading of the channel in alarm blinks, with the red LEDs and the buzzer sounds at a rapid rate.

Action: Your Innova resets its alarms when normal gas levels return (if at the default setting **AUTO RESET**), or press **ON/OFF** button momentarily if the alarm latch (**MANUAL RESET**) has been enabled.

ALWAYS investigate the cause of any alarm indication.

Fail Indication

A fail indication occurs when a sensor or other circuitry no longer functions normally.

Visual/audible indications: The display for a sensor(s) read XXX. The red LEDs are on, and the buzzer sounds continuously.

Possible causes: A sensor may be bad, missing or have a loose connection. An internal circuit fault may have occurred.

Action: Remove the Innova from the monitoring area. Investigate and determine the cause, refer to the Troubleshooting section of your Operator's Manual for specific instructions.

Low Flow Indication

A low flow indication occurs when normal flow is interrupted. The Innova's pump automatically shuts off.

Visual/audible indications: The words PRESS →TO CLEAR are shown, and alternates with the normal and **PUMP FAILED** screens. An X appears where the spinning icon was. The red LEDs alternate, and the buzzer sounds in a pulsing pattern.

Possible causes: Liquid has been drawn into the probe, or an obstruction is present. An internal circuit fault may have occurred. A sensor may not be properly installed. The hydrophobic filter in the probe may be dirty.

Action: Clear away visible obstructions, then press →(**ON/OFF**) to restart the pump. If the problem remains, troubleshoot the probe, hose, sensor(s) or internal flow system for obstructions.

Low Battery Indication

A low battery indication occurs when the battery voltage drops below the battery alarm threshold.

Visual/audible indications: The words **LOW BATTERY** are shown. The red LEDs are on, and the buzzer sound emits a double pulse every 60 seconds.

Probable cause: The batteries have reached the end of useful life.

Action: You must replace alkaline or recharge or replace NiCd batteries before continuing. Refer to the Maintenance Chapter of your Operator's Manual for specific instructions.

CAUTION

This quick reference card does not adequately replace your operator's manual. Refer to the manual for detailed information, or for other indications not covered on this card, such as TWA, PEAK, and STEL, and all other functions.

Thermo GasTech
1.877.GAS.TECH (USA)
www.thermogastech.com
sales@thermogastech.com

In Canada
1.403.291.4700
www.thermogastech.ca
sales@thermogastech.ca

Date 09/12/00
SOP# _____
Rev # DRAFT

UTILITIES AND STRUCTURES CHECKLIST FORM

Project: _____

Location: _____ Date: _____

Instructions. This checklist has to be completed by a *SECOR* staff member as a safety measure to insure that all underground utility lines, other underground structures as well as above-ground power lines are clearly marked out in the area selected for boring or excavation. **DRILLING OR EXCAVATION WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Assignment of Responsibility. *SECOR* is responsible for having underground utilities and structures located and marked. Preferably, the utility companies themselves should mark out the lines.

Drilling or Excavation Sites. Attach a map of the property showing the drilling or excavation sites, if sites are widely separated, several map(s) clearly indicating the area(s) checked for underground utilities or underground structures and the location of above-ground power lines.

Utilities and Structures

TYPE	NOT PRESENT	PRESENT	HOW MARKED[1]
Petroleum products line			
Natural gas line			
Steam line			
Water line			
Sewer line			
Storm drain			
Telephone cable			
Electric power line			
Product tank			
Septic tank/drain field			
Other			

[1]Flags, paint on pavement, wooden stakes, etc.

Client Approval _____ _____ _____
(with attached map) **NAME** **COMPANY** **PHONE**

Name and affiliation of person who marked out underground lines or structures.

_____ _____ _____
NAME **COMPANY** **PHONE**

SECOR International Incorporated *(SECOR)*

Field Team Leader _____ **Date Completed** _____

SECOR
BORING/MONITORING WELL LOG

	DATE	SECOR PROJECT NUMBER	MONITORING WELL/ BORING NUMBER	PA
	WEATHER CONDITIONS	CLIENT	SITE LOCATION	

☐ SOIL BORING ONLY
☐ SOIL BORING COMPLETED AS MONITORING WELL

DRILLING METHOD	SOIL SAMPLING METHOD	LOCATION SKETCH	
DRILLING COMPANY	DRILLING START / DRILLING FINSIH	DEPTH TO WATER DURING DRILLING	
BORING BACKFILL MATERIAL	BORING LOGGED BY	DEPTH TO WATER AFTER WELL SET	

DEPTH (in feet)	BLOW COUNTS Per 0.5 Feet	RECOVERY (Feet)	MOISTURE CONTENT	PENETROMETER READING (TSF)	PID/FID (ppmv)	PROFILE	DESCRIPTION	WELL DIAGRAM

CHECKED BY: DATE: ▽ INITIAL WATER LEVEL ▼ STATIC WATER LEVEL

AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

DATE	INSTRUMENT/ MODEL NO.	SERIAL NO.	BATTERY CHECK OK?	ZERO ADJUST OK?	CALIBRATIOI GAS (PPM)	READING (PPM)	LEAK CHECK	PERFORMED BY	COMMENTS

AIR MONITORING LOG

DATE	TIME	LOCATION	SOURCE/AREA/ BREATHING ZONE	INSTRUMENT	CONCENTRATION/UNITS	SAMPLED BY

* Submit copies of logs to Director of Industrial Hygiene & Health and Safety, Philip A. Platcow, CIH within 24 hours, if a PEL is exceeded, or personal protective equipment level is upgraded at (617) 232-7355 or via email at pplatcow@secor.com

SECOR *International Incorporated*

GROUNDWATER SAMPLING FIELD DATA SHEET

SECOR PN: _____ DATE: _____ WELL #: _____

FACILITY NAME: _____ TEMPERATURE: _____ °F or °C

FIELD PERSONNEL: _____ WEATHER: _____

FIELD MEASUREMENTS:

A. Static Water Level (SWL) below top of casing/piezometer: _____ FT. or IN.
B. Thickness of Free Product, if present: _____ Inches _____ FT. or IN.
C. Total Depth of well (TD) from top of casing/piezomenter: _____ FT. or IN.
D. Height of Water Column in casing (h=TD-SWL): _____ FT. or IN.
E. **Useful approximate Purge Volumes (PV) per foot of water for common casing sizes:** _____ _____

PURGING METHOD: _____ DURATION: _____

OBSERVATIONS:

	Time	Turbidity	Color	Sheen	pH	Temp.	Conduct	SWL
1st Volume:								
2nd Volume:								
3rd Volume:								
4th Volume:								
Addnl. Volumes:								

TOTAL VOLUME OF WATER PURGED FROM WELL: _____

PURGE WATER STORED / DISPOSED OF WHERE / HOW: _____

SAMPLES COLLECTED: Depth to Water at time of sample collection: _____

Sample Numbers	Type	Time	Size/Number of Container(s)	Preservative

COMMENTS:

_____

_____

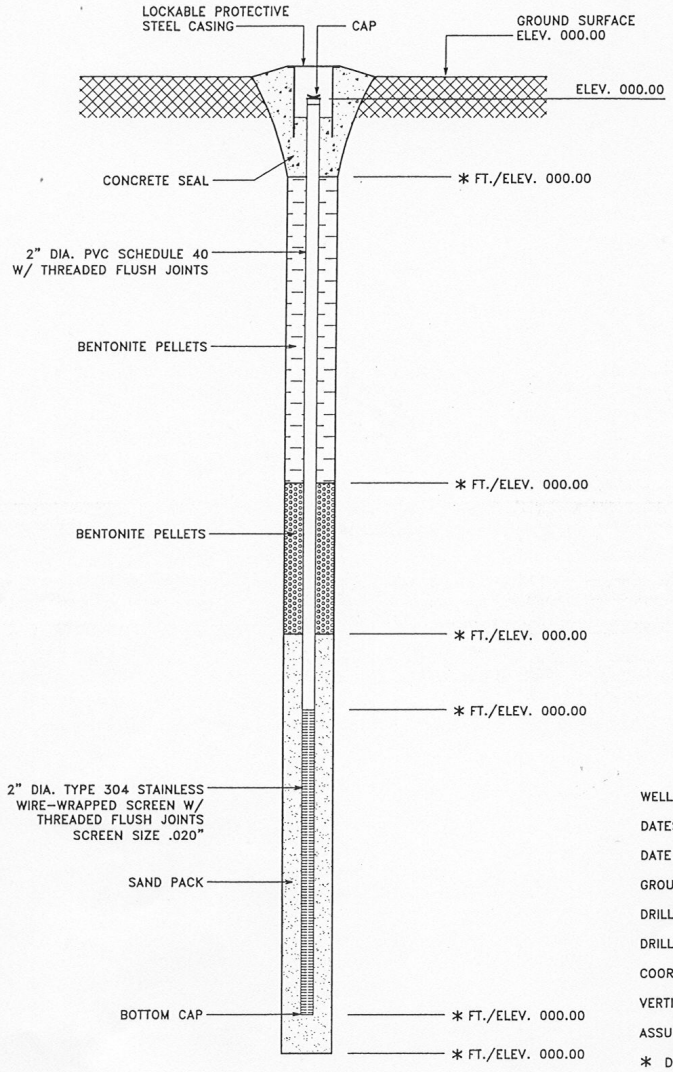
_____

Casing Capacities:
2-inch hole .....0.16 gal/lin ft.
4-inch hole .....0.65 gal/lin ft.
6.5-inch hole .....1.70 gal/lin ft.
8-inch hole .....2.60 gal/lin ft.
10-inch hole .....4.10 gal/lin ft.

Recharge Calculation at Time of Sample Collection:

Total Depth of Well: _____
Original Water Column: _____ X 0.80 = -(_____)
Collect sample when Depth to Water measures
Less than or equal to: _____

Signature: _____



WELL NUMBER _____

DATES DRILLED _____

DATE INSTALLED _____

GROUND WATER ELEV.

DRILLER _____

DRILLING METHOD _____

COORDINATES _____

VERTICAL DATUM: _____

ASSUMED _____ U.S.G.S. _____

* DEPTH BELOW _____

MONITORING WELL COMPLETION DETAIL – EXAMPLE

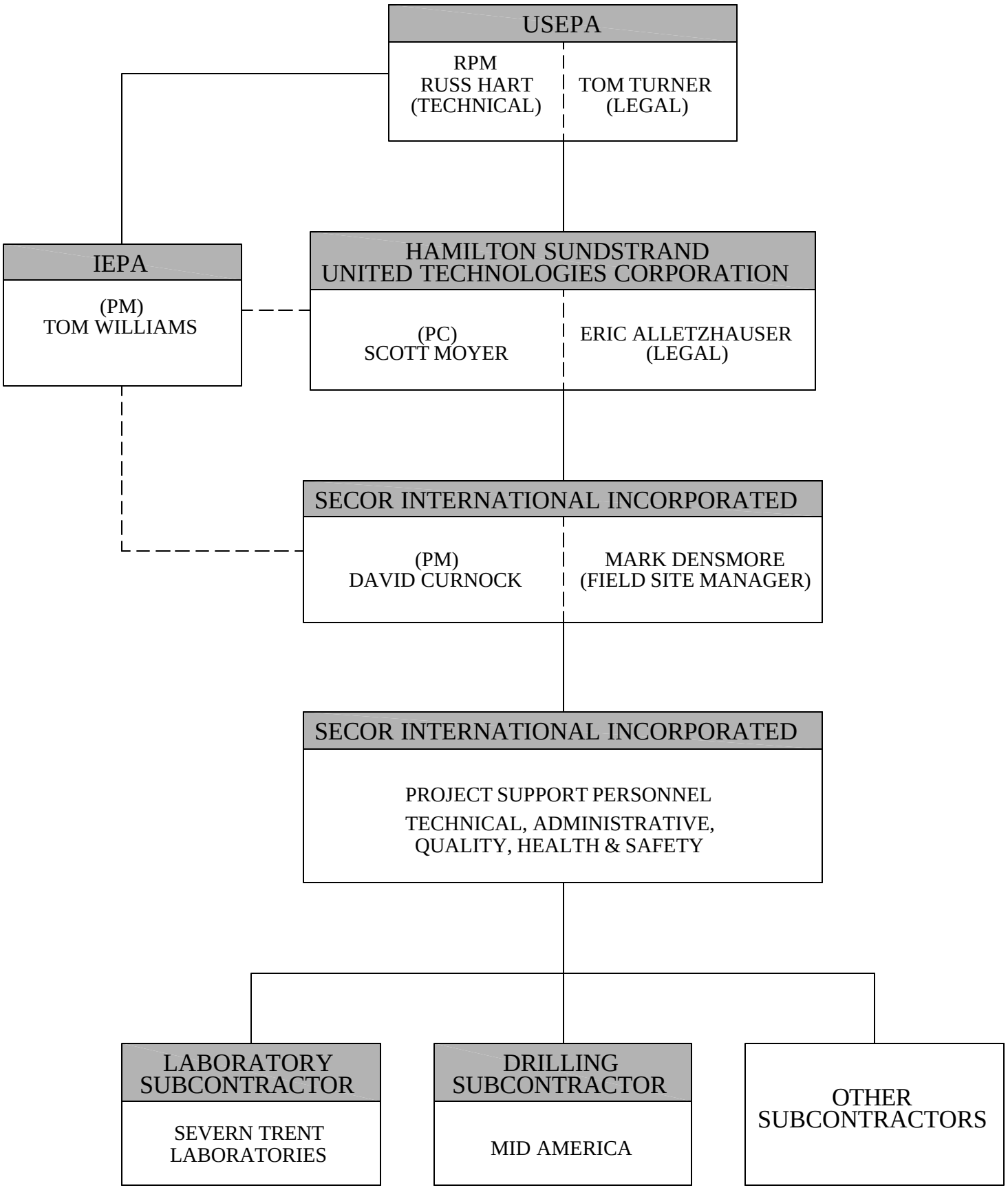
SECOR
International Incorporated

PROJECT TITLE
LOCATION
SITE LOCATION

JOB NO. 000.00000.000 FIGURE 0

DRAWING FILE INFO DATE

FIGURE 5
ORGANIZATION CHART



GUARD STATION

GATE 8

PARKING

NINTH STREET

VESM-1 VESM-2 VE-1 AS-1 VESM-3

AIR/ WATER SEPERATOR

SVE BLOWER

AS COMPRESSOR

VAPOR TREATMENT SYSTEM (IF NEEDED)

CONTROL PANEL

GROUND WATER FLOW

ASDM-4

VEDM-4
ASDM-1

VEDM-6
ASDM-3

VEDM-5
ASDM-2

ILLINOIS CENTRAL RAILROAD

GATE RR1

LEGEND:

- △ SOIL VAPOR EXTRACTION WELL
- ▲ VAPOR EXTRACTION WELL
  - VESM – SHALLOW WELL
  - VEDM – DEEP WELL
- ⊕ AIR SPARGING WELL
- ⊗ AIR SPARGE MONITORING WELL
  - ASDM – DEEP WELL

NOTE: CONCEPTUAL PURPOSES ONLY. LAYOUT FEATURES ARE BASED ON DRAWINGS PREPARED BY HARDING LAWSON ASSOCIATES, INC. 1992.

NORTH

0 2 5 10
SCALE IN FEET

DESIGNED BY:	JGH
DRAWN BY:	GLH
APPROVED BY:	DMC
DATE:	3-18-03

SECOR

PILOT TEST SYSTEM LAYOUT
OUTSIDE STORAGE AREA
HAMILTON SUNDSTRAND
AREA 9/10
ROCKFORD, ILLINOIS

JOB NO. 13UN.02072.00 FIGURE 4

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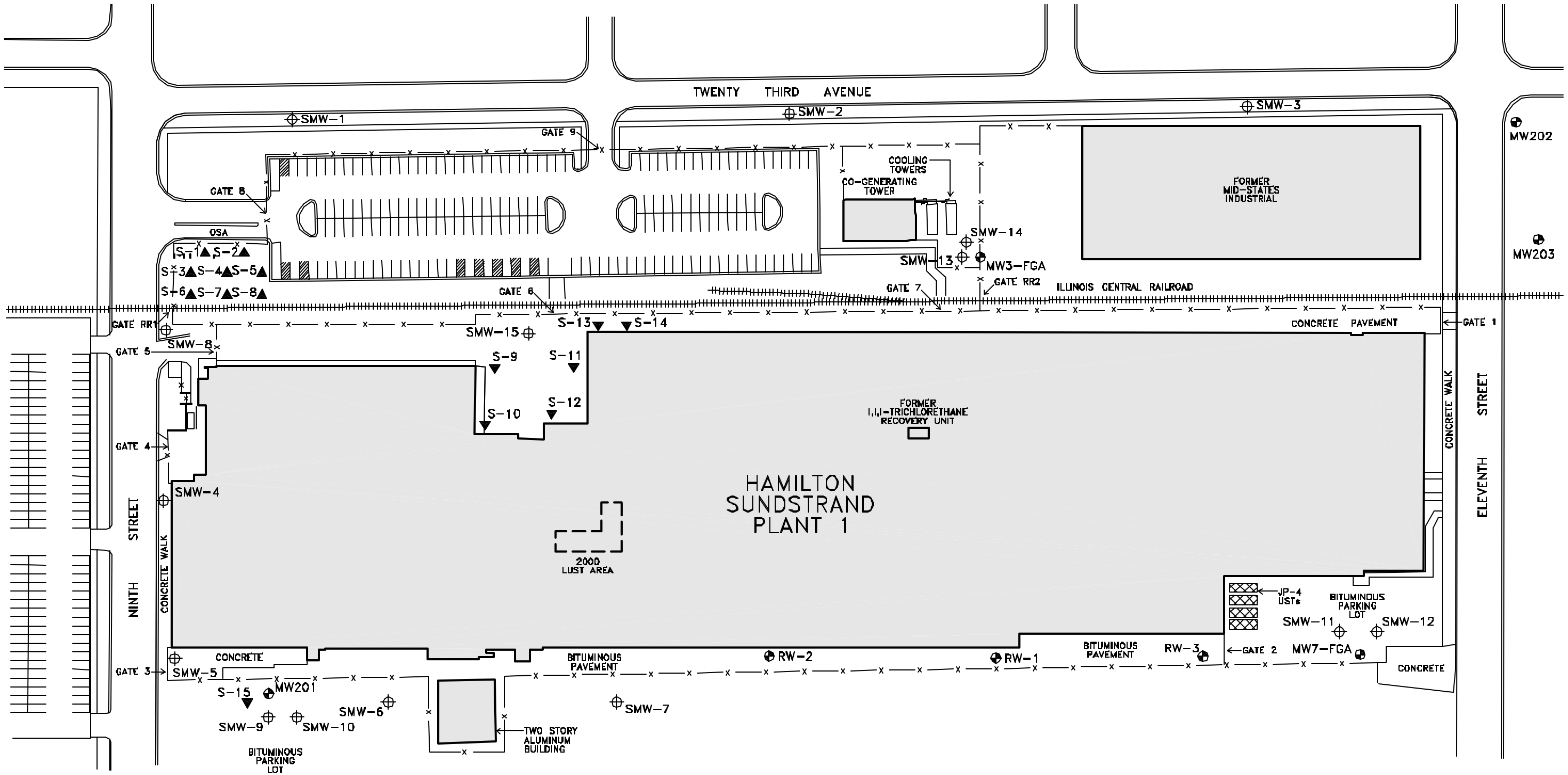


LEGEND:

- EXISTING MONITORING WELL
- FENCELINE
- PROPOSED SOIL BORING
- PROPOSED SOIL BORING/MONITORING WELL

NORTH

0 20 50 100
SCALE IN FEET

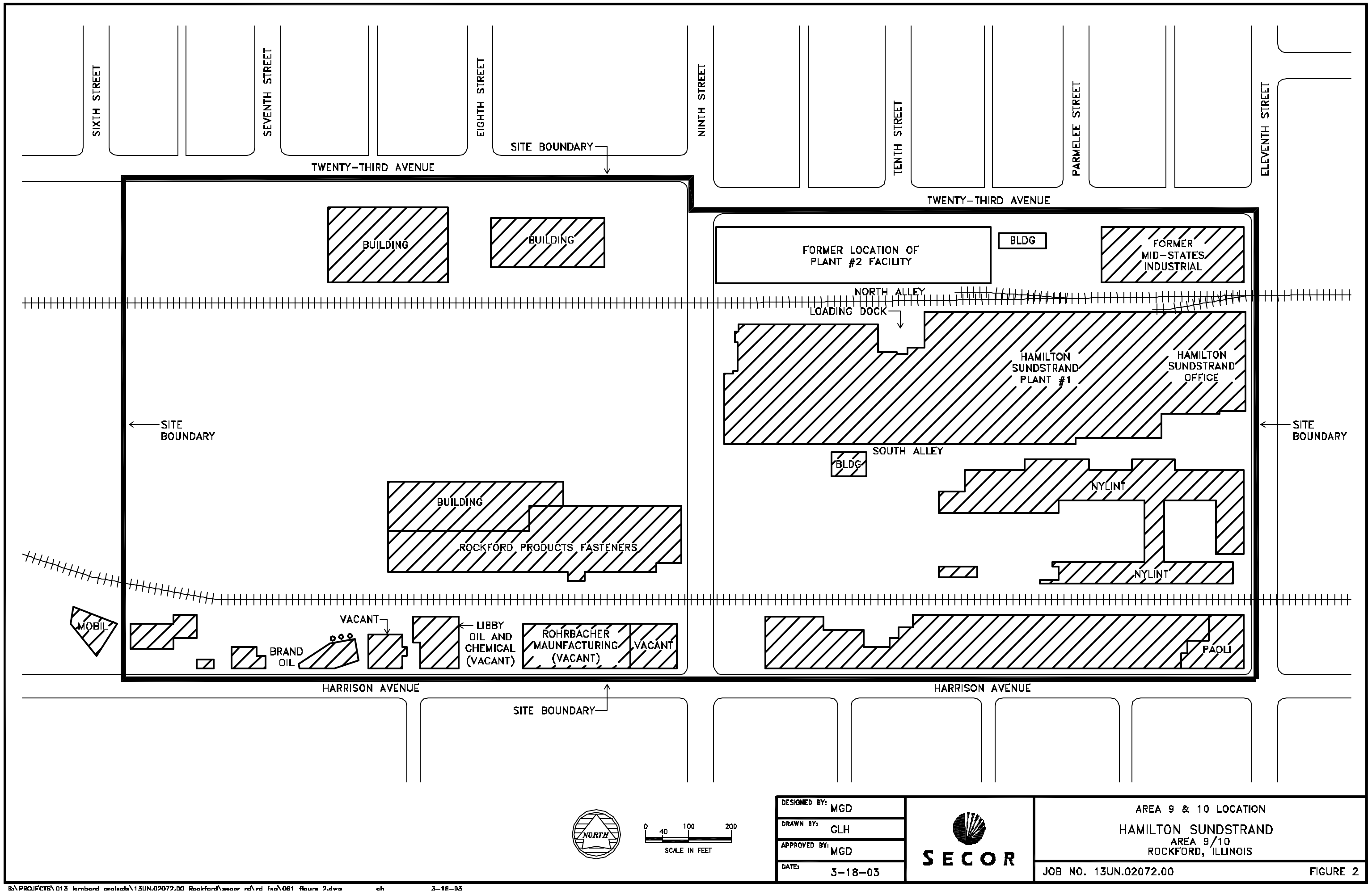
DESIGNED BY:	MGD
DRAWN BY:	GLH
APPROVED BY:	MGD
DATE:	3-18-03

SECOR

SITE MAP INCLUDING PROPOSED SOIL BORING AND MONITORING WELL LOCATIONS
HAMILTON SUNDSTRAND
AREA 9/10
ROCKFORD, ILLINOIS

JOB NO. 13UN.02072.00 FIGURE 3

B:\PROJECTS\013 lombard projects\13UN.02072.00 Rockford\secor rd\rd fns\061 figure 3.dwg ch 3-18-03



DESIGNED BY:	MGD
DRAWN BY:	GLH
APPROVED BY:	MGD
DATE:	3-18-03

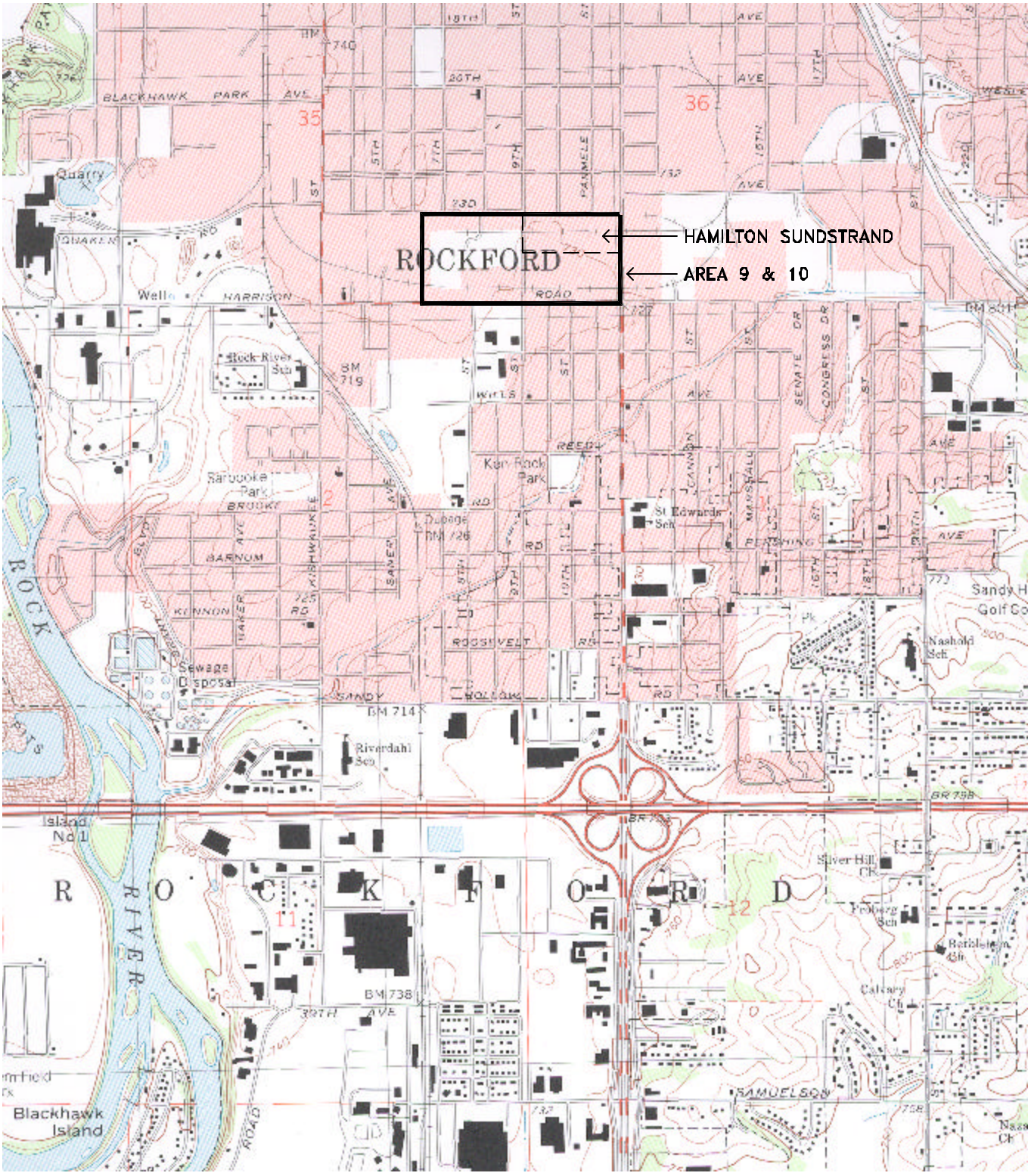
SECOR

AREA 9 & 10 LOCATION

HAMILTON SUNDSTRAND
AREA 9/10
ROCKFORD, ILLINOIS

JOB NO. 13UN.02072.00 FIGURE 2

S:\PROJECTS\013 lombard arcleads\13UN.02072.00 Rockford\secor rd\rd fns\061 figure 2.dwg gh 3-18-03



REFERENCE: USGS 7.5 MINUTE QUADRANGLE: ROCKFORD SOUTH, IL

DESIGNED BY: GLH	SECOR	SITE LOCATION MAP
DRAWN BY: GLH		HAMILTON SUNDSTRAND AREA 9/10 ROCKFORD, ILLINOIS
APPROVED BY: JGH		
DATE: 3-18-03		JOB NO. 13UN.02072.00 FIGURE 1

S:\PROJECTS\013 lombard projects\13UN.02072.00 Rockford\secor rd\rd fso\061 figure 1.dwg gh 3-18-03